# ATTACHMENT 4 – ENVIRONMENTAL ANALYSIS

# FINDING OF NO SIGNIFICANT IMPACT AND DECISION RECORD

## *For the Sonoran Desert National Monument Travel Management Plan Environmental Assessment*

**DOI-BLM-AZ-P040-2012-005-EA**

**FONSI:** Based on the analysis of potential environmental impacts contained in the attached environmental assessment, and considering the significance criteria in 40 CFR 1508.27, I have determined that implementing the actions as modified in the Decision Record below, would result in a Finding of No Significant Impacts on the human environment. Therefore, an environmental impact statement is not necessary to further analyze the environmental effects of the proposed actions.

### DECISION RECORD:

**Introduction:** This document explains my decision and rationale for implementing the sign and route rehabilitation plans necessary to execute the travel management system for the Sonoran Desert National Monument (SDNM), administered by the Bureau of Land Management (BLM) Lower Sonoran Field Office (LSFO). These decisions are implementation-level which tier from the higher level Sonoran Desert National Monument Approved Resource Management Plan (RMP). In the RMP, land allocation decisions, in addition to the designation of a 411-mile travel route system, were analyzed and approved in accordance with National Environmental Policy Act (NEPA) and applicable BLM laws, regulations and policies. Appropriate public and internal scoping commensurate with the action were conducted as part of the planning process. Through the interdisciplinary planning phases the public were afforded opportunities to participate in the process, review decisions proposed, and provide comments for consideration. This document only addresses the two remaining implementation-level decisions necessary to initiate the decisions that require further NEPA analysis not already considered in the RMP.

The administrative record is available at the BLM Phoenix District Office, 21605 North 7th Avenue, Phoenix, Arizona. Direct questions about this Decision Record or the associated environmental analysis may be directed to Thomas Bickauskas, Travel Management Coordinator, at 623-580-5502. The Record of Decision for the RMP can be reviewed at the BLM website at www.blm.gov/az/st/en/prog/planning/son_des.html. These implementation decisions are subject to appeal. Appeal procedures are described on page 6 of this document.

**Project Description:** The environmental assessment (EA), Attachment 4 of the accompanying Travel Management Plan (TMP), analyzed the impacts associated with implementing two components of the TMP: the signing of 411 miles of routes and the rehabilitation and decommissioning of 204 miles of primitive roads located on public lands within the Sonoran Desert National Monument (SDNM). In two action alternatives, the BLM proposes to install approximately 2,150 signs and rehabilitate 204 miles of primitive roads on 486,400 acres of BLM-administered public lands east of Gila Bend, Arizona.

**Background:** The SDNM was designated in 2001 by Presidential Proclamation 7397. The proclamation mandated a prohibition of off-road driving and directed BLM to designate a travel system. Many miles of dirt roads and trails, in existence prior to the Monument was created, became the interim route system until individual route designations could be made. A thorough mapping of existing roads and trails was completed in 2003. Sensitive resources and Monument Objects were identified and considered in context with the existing roads and trails. Through a nine year planning process, route system alternatives were created to meet the objectives for the corresponding plan alternatives and were presented to the public. Regulations found in 43 CFR 8342.1 formed the basis for reviewing and considering effects on natural and cultural resources. The TMP and this accompanying EA has been written by the BLM to implement all aspects of managing the designated route system.

**Decision:** The decision to be made is my approval and direction to begin implementing the proposed actions addressed in the EA as modified in this Decision Record. These include the following:

1) Selection of a comprehensive signing plan;
2) Selection of a strategy and methods for closing routes;
3) Identification of actions that conserve special status wildlife species, cultural resources and monument objects.

***Signing:*** About 411 miles of roads, primitive roads and trails will be signed for visitor navigation and information. Additional signs will be placed to delineate Monument boundaries, important locations, points of interest throughout the Monument and other management areas. The installation of approximately 150 large signs and up to 2,000 small fiberglass signs is reasonable and necessary to communicate rules, information and to provide needed visitor services. It is my decision to implement the sign plan as presented in the TMP and EA.

***Rehabilitation:*** Just over 204 miles of closed primitive roads will be decommissioned and rehabilitated. This action is necessary to implement the approved route designations. Considering the ongoing border related activities that have put Monument resources at risk, it is my decision to combine elements from the more mechanized reclamation alternative (identified as the Very Active alternative in the EA) with the more passive, indirect reclamation alternative. The mechanical method of using a harrow towed by an ATV will be heavily

employed in the Vekol Valley and the Smith Road area, east of Table Top Mountain Wilderness. Ripping would not be conducted in this area, thus greatly reducing the likelihood of unearthing buried artifacts. **Table 9**, Approved Rehabilitation Plan by Method and Miles, and **Maps 13 and 14**, Approved Rehabilitation Plan for Closed Routes North and South of I-8, at the end of this document show the Approved Rehabilitation Plan, as modified in this Decision Record.

**Table 1. Approved Rehabilitation Plan by Method and Miles**

| Rehabilitation Method | Miles |
|---|---|
| Harrow (south of I-8) | 43.1 |
| Rip/harrow (north of I-8) | 8.0 |
| Berm and sign | 3.6 |
| Vertical mulch/seed with berm and sign | 40.6 |
| Sign | 24.5 |
| Sign and fence | 33.9 |
| Sign and rake out tracks | 7.1 |
| Rake out tracks | 9.0 |
| Passive | 34.6 |
| Total | 204.3 |

***Tortoise Habitat:*** Reclamation, to include route closures, in Category I, II and III desert tortoise habitat will result in the defragmentation of approximately 215 linear acres of habitat. Approximately 215 acres of desert tortoise habitat are being banked as compensation for future projects such as recreation improvements along the Butterfield/Juan Bautista de Anza trail corridor. **Table 10**, Desert Tortoise Habitat Returned to Productive Habitat, describes the category and acreage associated with them.

**Table 2. Desert Tortoise Habitat Returned to Productive Habitat**

| Habitat Class | Miles Closed | Avg Route Width (Ft) | Ft/Mile | Total Sq. Ft. | Sq. Ft. /Acre | Acres |
|---|---|---|---|---|---|---|
| Category 1 | 59.1 | 12 | 5,280 | 3,747,110.4 | 43,560 | 86.0 |
| Category 2 | 83.8 | 12 | 5,280 | 5,311,468.8 | 43,560 | 121.9 |
| Category 3 | 5.4 | 12 | 5,280 | 344,678.4 | 43,560 | 7.9 |
| Total all habitat categories | | | | | | 215.9 |

**Rationale:** This decision is based upon conformance with the Monument Proclamation, RMP and the intense level of public involvement and comment during the RMP process. The TMP components implement the primary RMP goal TM-4 that directs the creation of the TMP and management of the route system. Compliance with off-road vehicle regulations in 43 CFR 8342.1 is evident through the management actions contained within the TMP and the proposed actions contained within the accompanying EA.

The BLM analyzed three alternatives in the EA to review methods for completing the closures and signing the routes and areas of the Monument. The analysis shows that using more passive methods would provide a high degree of protection to cultural objects of the Monument while having negligible effects on wildlife. My decision to combine elements of both action alternatives allows for accelerated removal of the routes in the Vekol Valley, the Smith Road area and where otherwise identified by the authorized officer. This will assist with remediation of smuggling impacts. While smuggling is illegal, its effects persist and create a situation whereby well-intentioned citizens will likely find it difficult to comply with the route designations if these closed routes are not aggressively rehabilitated. While cultural resource survey will be completed where required before ground disturbing activities will be authorized, the exclusive use of a harrow towed by an ATV, rather than ripping using a bulldozer in the areas south of I-8, would potentially reduce disturbance to undiscovered cultural resources. The harrow has a shallow cut and can be portaged by lowering the wheels and avoiding ground disturbance in sensitive resource areas.

Banking a tortoise habitat credit of 215 acres will allow future actions intended to support BLM management to be in compliance with tortoise compensation requirements of Instruction Memorandum AZ-2009-010 Desert Tortoise Mitigation Policy. Compensation may be a concern in future activity level planning to allow reopening of the temporary closure area north of SR-238/Maricopa Road. Compensation for additional projects outside SDNM would be considered if a credit remains and is needed elsewhere.

In conclusion, I assert this rationale for my decision because it is based on the completeness and reasonable approach of the TMP and the analysis presented in the EA showing negligible or minor effects to resources. It is my belief that this decision would improve the manageability and condition of SDNM. Upon the signing of this decision, along with the approval of the accompanying TMP, I am ordering all components of the TMP and the proposed actions as modified in this Decision Record to be implemented as described. This decision has no adverse impact on energy development, production, supply and/or distribution.

**Mitigation Measures:** During the environmental review, no residual effects were identified requiring mitigation providing best management practices and standard operating procedures for such actions are followed.

**APPEALS:** This decision may be appealed to the Interior Board of Land Appeals, Office of the Secretary, in accordance with the regulations contained in 43 CFR, Part 4. Public notification of this decision will be considered to have occurred on September 14, 2012. Within 30 days of this decision, a notice of appeal must be filed in the office of the Authorized Officer at 21605 N. 7th Avenue, Phoenix, AZ 85027. The last day to file an appeal is October 15, 2012. If a statement of reasons for the appeal is not included with the notice, it must be filed with the Interior Board of Land Appeals, Office of Hearings and Appeals, U.S. Department of the

Interior, 801 North Quincy St., Suite 300, Arlington, VA 22203 within 30 days after the notice of appeal is filed with the Authorized Officer.

If you wish to file a petition for stay pursuant to regulation 43 CFR Part 4.21(b), the petition for stay should accompany your notice of appeal and shall show sufficient justification based on the following standards:

1. The relative harm to the parties if the stay is granted or denied,
2. The likelihood of the appellant's success on the merits,
3. The likelihood of immediate and irreparable harm if the stay is not granted,
4. Whether the public interest favors a granting the stay.

If a petition for stay is submitted with the notice of appeal, a copy of the notice of appeal and petition for stay must be served on each party in the decision from which the appeal is taken, and with the IBLA at the same time it is filed with the Authorized Officer. A copy of the notice of appeal, any statement of reasons and all pertinent documents must be served on each adverse party named in the decision from which the appeal is taken to: Field Solicitor, U.S. Department of the Interior, 401 West Washington Street, Suite 404, Phoenix Arizona, 85003, not later than 15 days after filing the document with the Authorized Officer and/or the IBLA.

## Field Manager Approval

The decision described above will not have any significant impacts on the human environment and the analysis included in the environmental assessment is sufficient. I have determined that the decision and proposed actions as modified above are in conformance with the land use plan. It is my decision to implement the proposed actions as modified above with the special considerations for rehabilitation as noted.

_____ _____

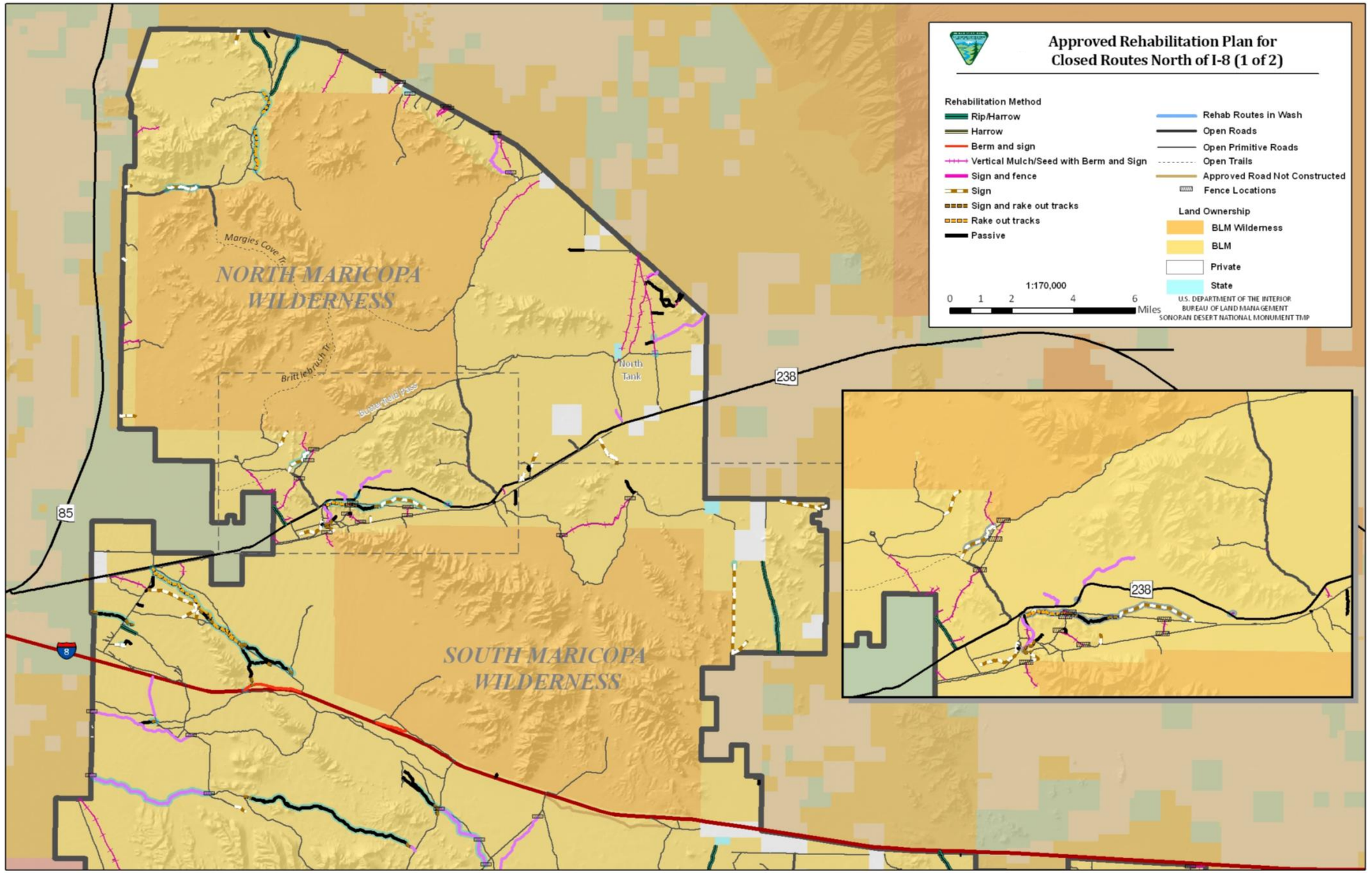
Emily Garber Date
Manager, Lower Sonoran Field Office

## Monument Manager Concurrence

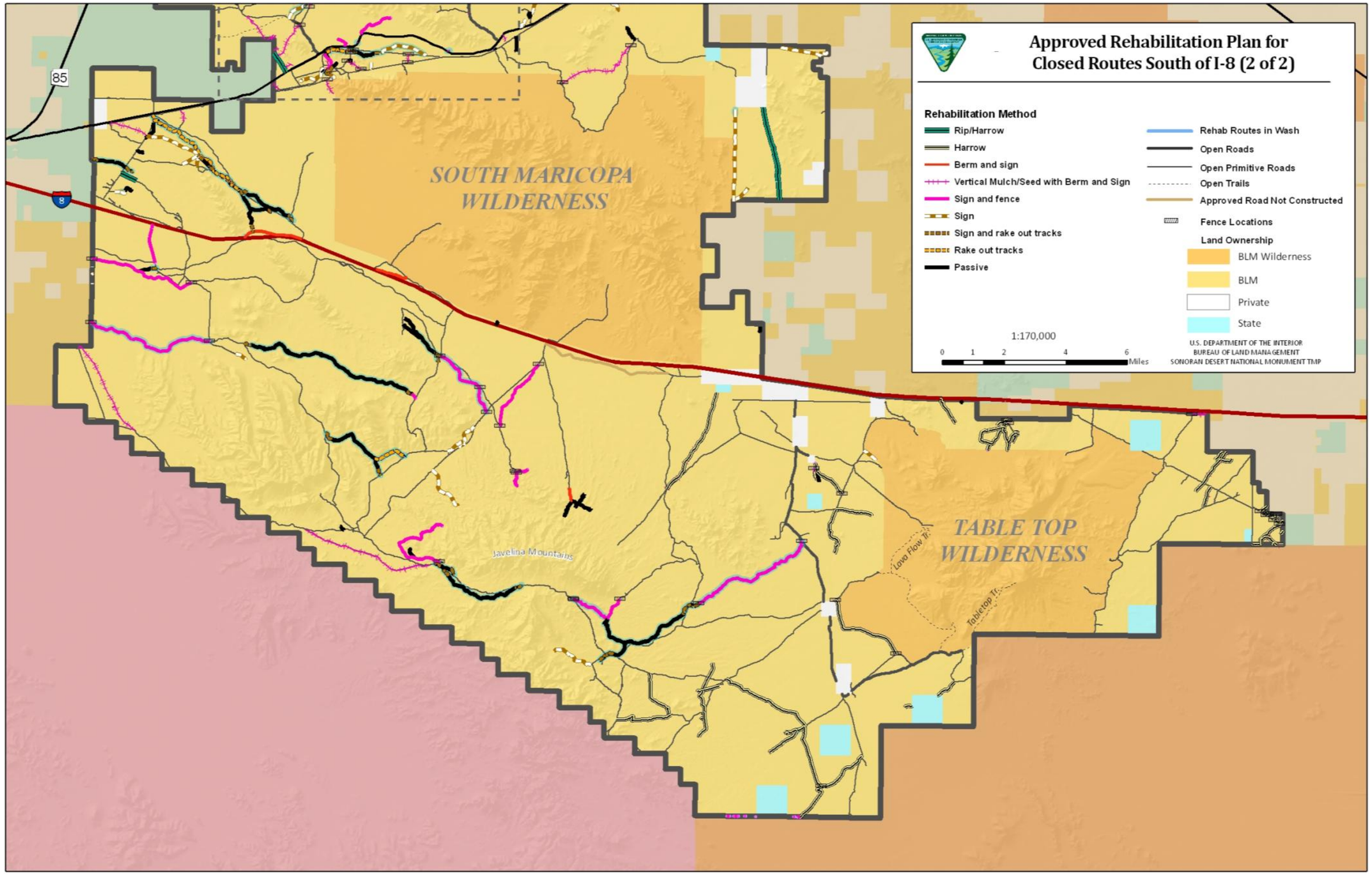
_____ _____

Richard B Hanson Date
Manager, Sonoran Desert National Monument

**Map 1. Approved Rehabilitation Plan for Closed Routes North of I-8**



**Map 2. Approved Rehabilitation Plan for Closed Routes South of I-8**



*United States Department of the Interior*
Bureau of Land Management
Lower Sonoran Field Office
Sonoran Desert National Monument

# SONORAN DESERT NATIONAL MONUMENT TRAVEL MANAGEMENT PLAN ENVIRONMENTAL ASSESSMENT

DOI-BLM-AZ-P020-2012-005-EA

September 14, 2012

# PURPOSE AND NEED

## INTRODUCTION

This environmental assessment (EA) is prepared to disclose and analyze the environmental consequences of the rehabilitation and decommissioning of 204 miles of primitive roads, and the signing of 411 miles of routes located on public lands within the Sonoran Desert National Monument (SDNM) as identified in the SDNM Travel Management Plan (TMP) through two action alternatives. The project area is the SDNM. (See **Table 11,** Location of Project Area, below, for legal descriptions of the project area). The EA analyzes potential impacts that could result with the implementation of the proposed action and alternatives identified. It is expected that additional site-specific environmental analyses may be necessary before such actions take place if it is determined that the analysis in this EA is not sufficient (such as site-specific analysis for aggressive rehabilitation actions).

**Table 3. Location of Project Area**

| Township/Range | Sections |
|---|---|
| T2S, R4W | 36 |
| T2S, R3W | 31, 32, 33, 34, 35, 36 |
| T2S, R2W | 31 |
| T3S, R4W | 1, 12 ,13, 23, 24, 25, 26, 35, 36 |
| T3S, R3W | 1-36 |
| T3S, R2W | 5, 6, 7, 8, 9, 10, 11, 13-36 |
| T3S, R1W | 19, 29, 30, 31, 32, 33, 34 |
| T4S, R3W | 1-36 |
| T4S, R2W | 1-36 |
| T4S, R1E | 2-36 |
| T4S, R4W | 2, 11, 14, 23, 26, 35 |
| T5S, R1E | 15-22, 27-34 |
| T5S, R2W | 1-36 |

| Township/Range | Sections |
|---|---|
| T5S, R1W | 1-36 |
| T5S, R3W | 1-6, 9-14, 16, 23-27, 29-36 |
| T5S, R4W | 23-26, 35, 36 |
| T6S, R1W | 1-36 |
| T6S, R2W | 1-36 |
| T6S, R1E | 3-7, 18-19, 29-32 |
| T6S, R3W | 1-36 |
| T6S, R4W | 1-2, 11-14, 23-26, 35, 36 |
| T7S, R3W | 1-29, 34-36 |
| T7S, R2W | 1-36 |
| T7S, R2E | 7-36 |
| T7S, R1E | 3-36 |
| T7S, R3E | 7-11, 14-36 |

| Township/Range | Sections |
|---|---|
| T7S, R1W | 1-36 |
| T7S, R4W | 1-3, 10-14 |
| T7S, R4E | 30-31 |
| T8S, R3W | 1 |
| T8S, R2W | 1-16, 23-25 |
| T8S, R1W | 1-30, 32-36 |
| T8S, R1E | 1-36 |
| T8S, R2E | 1-13, 19-21, 28-33 |
| T8S, R3E | 4-9, 16-18 |
| T9S, R1E | 1-18 |
| T9S, R1W | 1-3, 12 |

## PURPOSE AND NEED FOR ACTION

The Sonoran Desert National Monument (SDNM) proclamation identifies Monument objects that need protection. The SDNM Travel Management Plan (TMP) has been created to implement route designations that are intended to meet this purpose while providing access for allowable uses and management. The purpose for this environmental assessment is to review the expected and potential environmental effects of actions identified in the TMP. Actions for rehabilitation and signing have been identified as activities that require environmental review through an environmental assessment.

## Decisions to be Made

Decisions to be made include:

1) Selection of a comprehensive signing plan;
2) Selection of a strategy and methods for closing routes;
3) Identification of actions that conserve special status wildlife species, cultural resources and monument objects.

## Applicable Laws, Regulations and Orders

The following are the applicable laws, regulations, manuals and policies specific to the proposed action. A more comprehensive list of general laws governing land management actions can be found in the Lower Sonoran-SDNM Proposed RMP/Final EIS in Appendix B. Additional guidance is provided through Bureau of Land Management (BLM) Instruction Memoranda, manuals and handbooks:

- National Historic Preservation Act of 1966, as amended.
- BLM Manual 1626 -Travel and Transportation Management
- BLM Handbook 8342 -Travel and Transportation Management
- BLM Instruction Memorandum 2012-067, *Clarification of Cultural Resource Considerations for Off-Highway Vehicle(OHV) Designations and Travel Management*
- BLM Instruction Memorandum AZ-2009-010 Desert Tortoise Mitigation Policy

## Land Use Plan Conformance

This proposed action is in conformance with the SDNM Record of Decision and Approved Resource Management Plan (RMP) (September 14, 2012) and implements portions of the recreation, cultural resources, vegetation, soils and air quality sections. The following RMP decision provided the primary guidance by this plan.

TM-4: Protect Monument objects and resources, meet conservation and restoration goals, ensure sustainable public use and enjoyment, and satisfy public safety and regulatory requirements by developing a travel management plan and implement a sustainable and compatible travel management system.

## Background

### Route Designations and Implementation

Designating a system of routes was completed in the RMP. **Maps 15 and 16,** Travel System North and South of I-8, show the numbered routes designated in the RMP. Since this process of creating the TMP has been concurrent with the RMP process, route alternatives that reflect the resource decisions were proposed in the draft and proposed RMP alternatives. All TMP plan sections presented align with the routes designated in the RMP.

The actions to be analyzed, in two action alternatives, are those to rehabilitate, or return to a natural condition, 204 miles of primitive roads. These roads have been assigned a maintenance intensity of 0 through the route designation process.

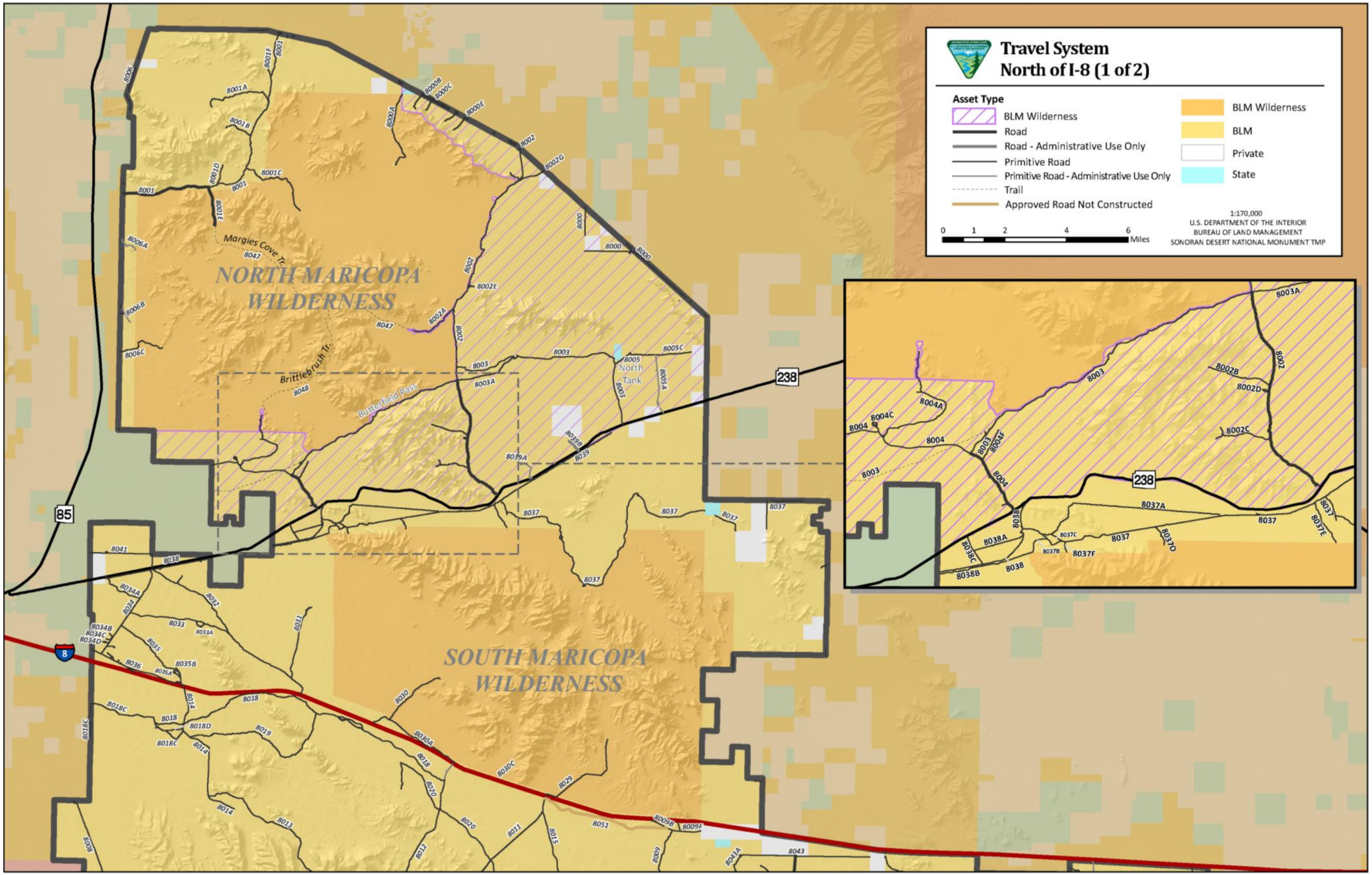
The sign plan is common to both action alternatives and is intended to implement the route designations and communicate travel information for visitor use on 411 miles of open roads, primitive roads and trails. Environmental review is needed for the installation of 2,000+ signs ranging from slender fiberglass route marking posts to multiple panel information kiosks.

Maps in the TMP Sign Plan (Attachment 2) display the currently identified locations for larger signage such as portal access (primary) signs, boundary identification (secondary) signs and information kiosk boards (special management area signs). 152 of these larger type signs have been identified. **Maps 11 and 12**, SDNM Access Points & Visitor Information Sign Locations North of I-8, (Attachment 2) displays the planned sign locations.

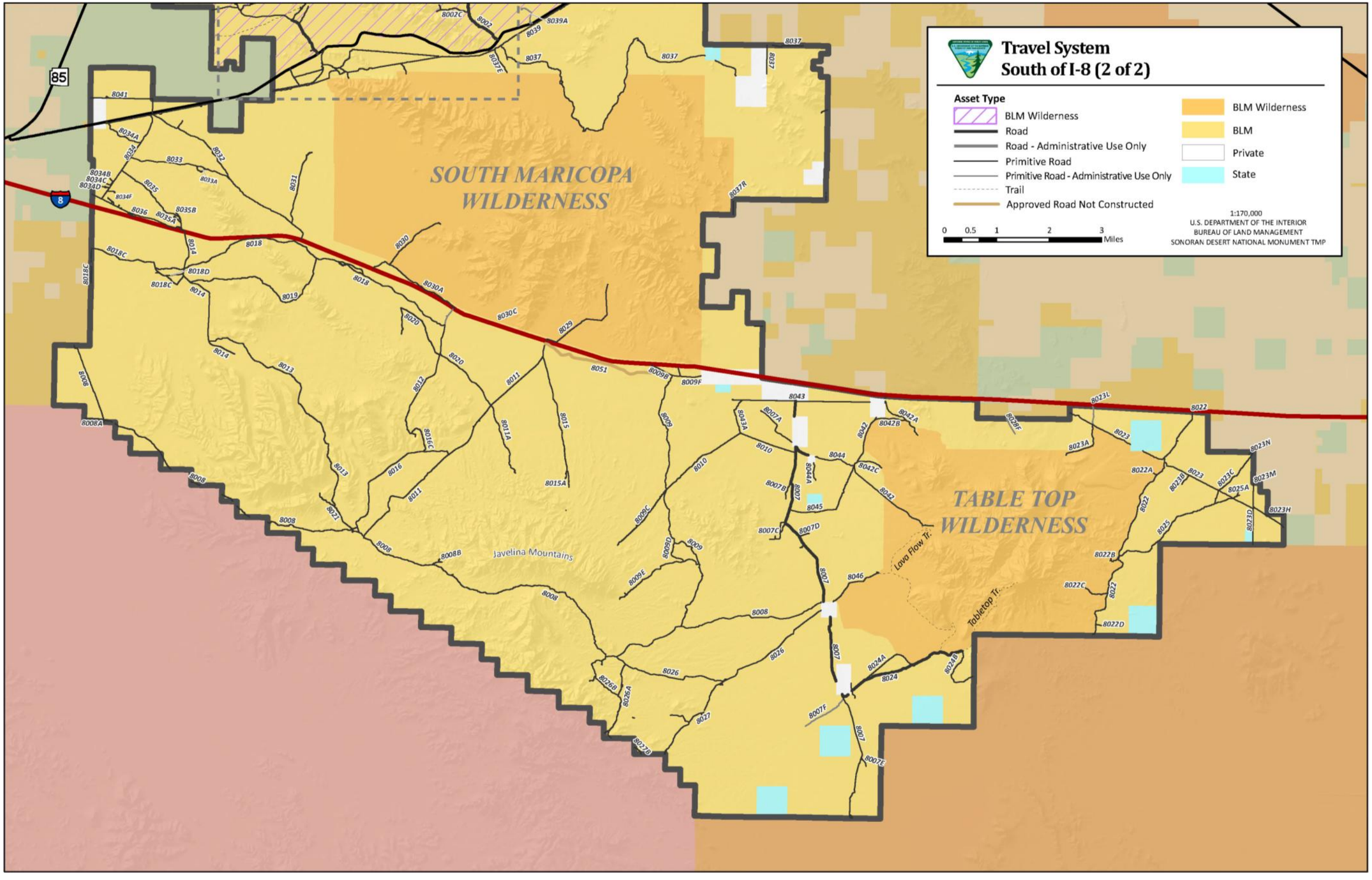
## SCOPING & PUBLIC PARTICIPATION

Specialists and managers participated in internal scoping to determine the issues and range of alternatives required for this analysis. The SDNM Scoping Report (2003) was consulted to consider any issues or suggestions that were raised during the RMP process that would warrant creation of an alternative.

**Map 3. Travel System North of I-8**



**Map 4. Travel System South of I-8**



# DESCRIPTION OF ALTERNATIVES

## INTRODUCTION

BLM specialists determined that three alternatives cover the range of reasonable scenarios required for environmental effects review. The actions considered include a common-to-all-alternatives plan for signing the open designated routes and two action alternatives for potential rehabilitation strategies. As required by NEPA, a no-action alternative is also considered.

The Travel Management Plan contains many implementation components that are necessary for management of a designated route system. BLM specialists determined that most of these components do not involve surface disturbance activities and are not, therefore, analyzed further in this section. These include: Education and Information, Monitoring, Adaptive Management, Enforcement, Legal Public Access/Landowner Access.

## DESCRIPTION OF SIGNING ACTION– COMMON TO BOTH ACTION ALTERNATIVES

The methods and locations of signs to be placed are contained in the TMP section named Travel Management Sign Implementation. Signs of varying size and type will be installed throughout SDNM to aide visitors, manage where vehicles are allowed and identify wilderness and monument boundaries and other areas within the Monument. Sign types will vary from slender fiberglass posts to large information boards measuring 4 feet by 4 feet. A more detailed version of the sign plan is found in the TMP in **Attachment 2**, SDNM Sign Plan.

Individual routes will be signed using a slender fiber glass post with a cross sectional area of two inches. This type of sign will be used to mark routes as open or closed, where necessary. Currently, approximately 1,000 of this type of sign are in use on SDNM. This number would be increased to approximately 2,000.

Larger signs would be used at up to 152 locations as shown in the Sign Plan. These signs would be constructed of metal or wood and used to mark key locations such as boundaries, trailheads, important junctions and provide information to visitors. Parking would be delineated near information kiosk boards for 1-2 cars and would be provided at approximately 20 locations. The total area expected to be disturbed through parking and sign installation totals up to 6 acres throughout the SDNM. The sign plan does not change between action alternatives.

## REHABILITATION ACTIONS – COMMON TO BOTH ACTION ALTERNATIVES

In both action alternatives, routes will be rehabilitated using various techniques ranging from allowing the route to naturally reclaim passively to complete mechanical ripping the route. Rehabilitation actions fall into a gradient between completely passive to very active. Completely

passive methods allow the route to reclaim naturally without outside work. Very active methods exert vigorous reclamation work to the ground to speed rehabilitation.

Two action alternatives are presented to analyze the effects of conducting work to rehabilitate routes in a more passive and more active manner. Each alternative's approach has positive and negative attributes and the environmental effects of each will be analyzed. Techniques and methodologies will be analyzed for their potential for promoting successful reclamation and outcomes while protecting monument objects in the short- and long-term.

### Best Management Practices, Criteria, Assumptions and Considerations Common to All Rehabilitation Actions:

- Seeding will be done where it would reasonably aid rehabilitation of closed routes. Appropriate native seed mixtures would be selected for each site based on site conditions. Seed application would occur prior to the winter rainy season. Some areas would be temporarily fenced to prevent disturbance.
- Barren areas near main roads where camping or parking is closed would be targeted for placement of such barriers.
- Lockable steel gates may be employed as a last resort where an area has been closed to public access yet administrative access is required to enforce area closures.
- Wire fencing will be employed in up to 300 ft sections to discourage vehicular travel around signage. Typical disturbance areas will total 0.034 acre per fence (fence project will be about five feet in width by up to 300 feet, totaling 1,500 sq. ft. (0.034 ac) per fence installation).
- Rehabilitation projects may be completed by BLM, volunteers, youth interns, conservation corps, or non-profit organizations through partnerships or contracts.
- Invasive species vegetation treatment control measures will be implemented as needed to promote re-vegetation with native plants and prevent new weed establishment and/or control of existing weed sources.
- Fencing may be included in rehabilitation projects where adjustments to grazing allotments or pastures are needed.
- Ripping/harrowing work will generally be completed when soil moisture is present to aid in the loosening soil compaction and reduce equipment wear. This may necessitate project implementation during the summer monsoon season.
- Rehabilitation and/or maintenance activities using tracked or full size vehicles, excluding ATV/UTV types, will be conducted with a Sonoran desert tortoise monitor or spotter present when conducting work during the tortoise active season. All work crews will be briefed on methods to avoid injuring tortoises.
- Site-specific NEPA-sufficient analyses will be conducted, as necessary, prior to implementing rehabilitation or maintenance actions or developing new routes or re-

routes. These analyses will address cultural resource clearances, changes in status of any object or wildlife species and project management issues.

## ALTERNATIVE 1 - PASSIVE REHABILITATION METHODS

This action alternative encompasses the following actions:

- Placement of signs on open and closed routes
- Placement of entry signs/kiosk boards
- Rehabilitation of closed routes by using less active methods

Rehabilitation of closed routes will be accomplished by a range of mostly passive methods. Alternative 1 proposes to implement the sign plan and conduct route rehabilitation using more passive methods to maintain existing vegetation, reduce the disturbance to wildlife and cultural resources and allow for using more unskilled labor for hand work tasks. (See **Table 12**, Rehabilitation Methods by Miles for Alternative 1). Refer to the TMP for a description of the rehabilitation methods proposed.

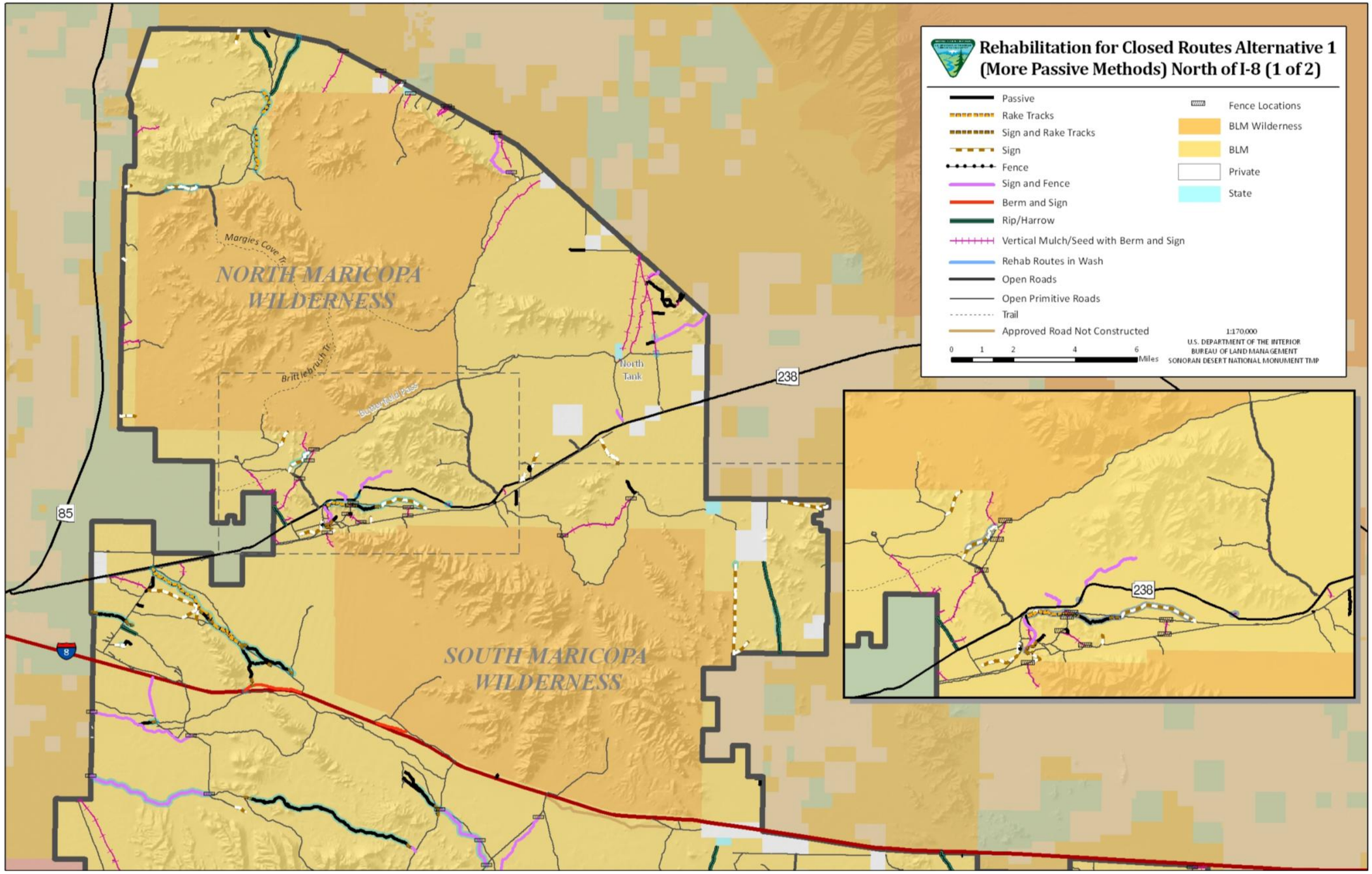
**Table 4. Rehabilitation Methods by Miles for Alternative 1**

| Rehabilitation Method | Miles |
|---|---|
| Berm and sign | 5.4 |
| Passive | 40.7 |
| Rake out tracks | 9.0 |
| Rip/harrow | 10.8 |
| Sign | 42.0 |
| Sign and fence | 41.1 |
| Sign and rake out tracks | 7.1 |
| Vertical mulch/seed with berm and sign | 48.2 |
| Total | 204.3 |

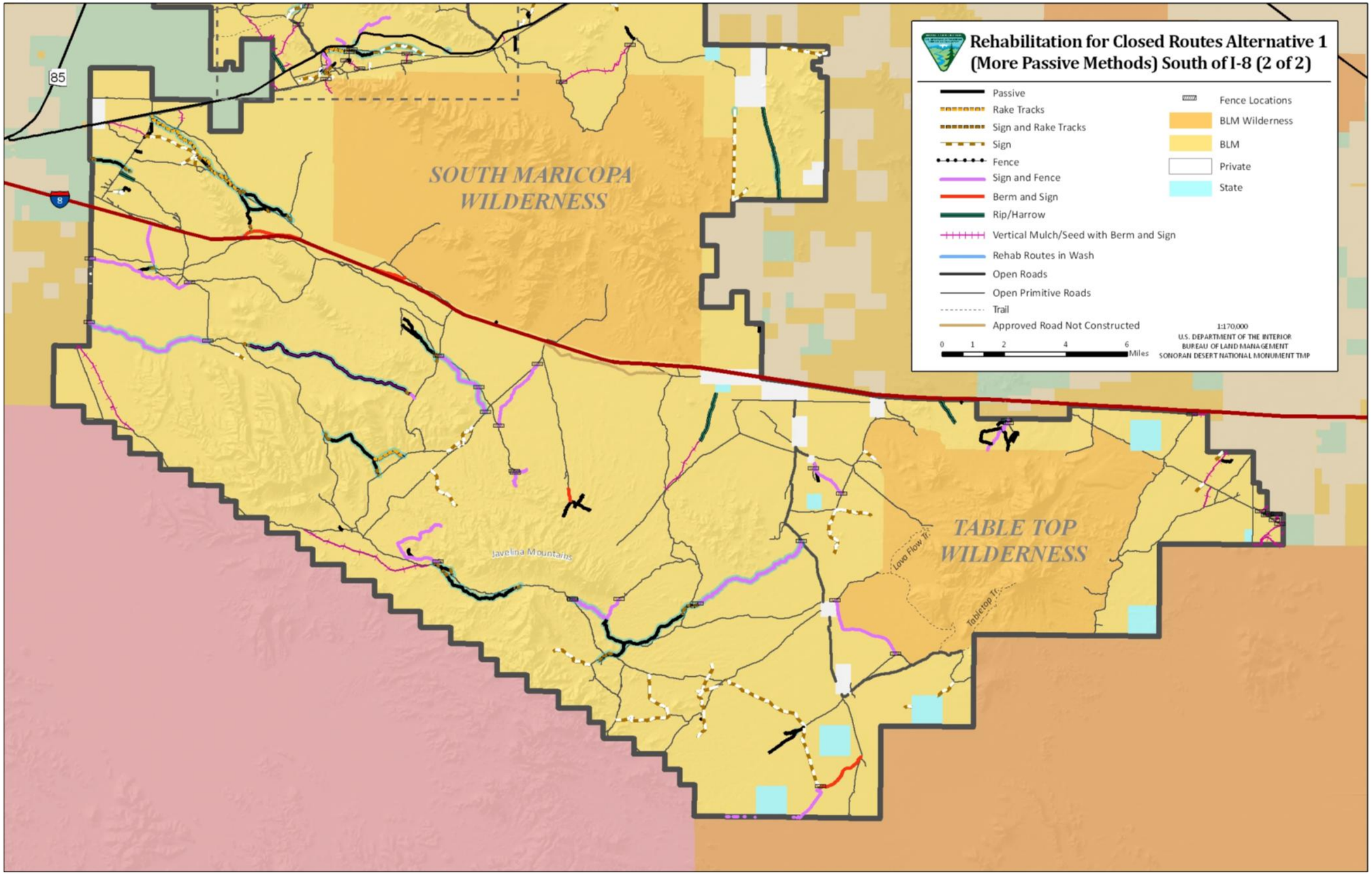
Fences will generally be the barrier of choice. Where fence cutting is prevalent, sites may need to be bolstered by upgrading to a buried post with two strands of cable type, pipe rail or steel rail type. Closed signs would be employed as necessary.

The rehabilitation plan would rip soils at eight locations, resulting in new temporary short-term disturbance of up to 13.0 acres along existing routes. Placement of fences at 48 locations would create a new disturbance of up to 1.6 acres. The total area of rehabilitation for the 204 miles of routes, assuming a 12 foot width average, equals 297.2 acres. Locations of project work are shown on **Maps 17 and 18**, Rehabilitation for Closed Routes for Alternative 1 (More Passive Method) North and South of I-8.

**Map 5. Rehabilitation for Closed Routes for Alternative 1 (More Passive Method) North of I-8**



**Map 6. Rehabilitation for Closed Routes Alternative 1 (More Passive Methods) South of I-8**



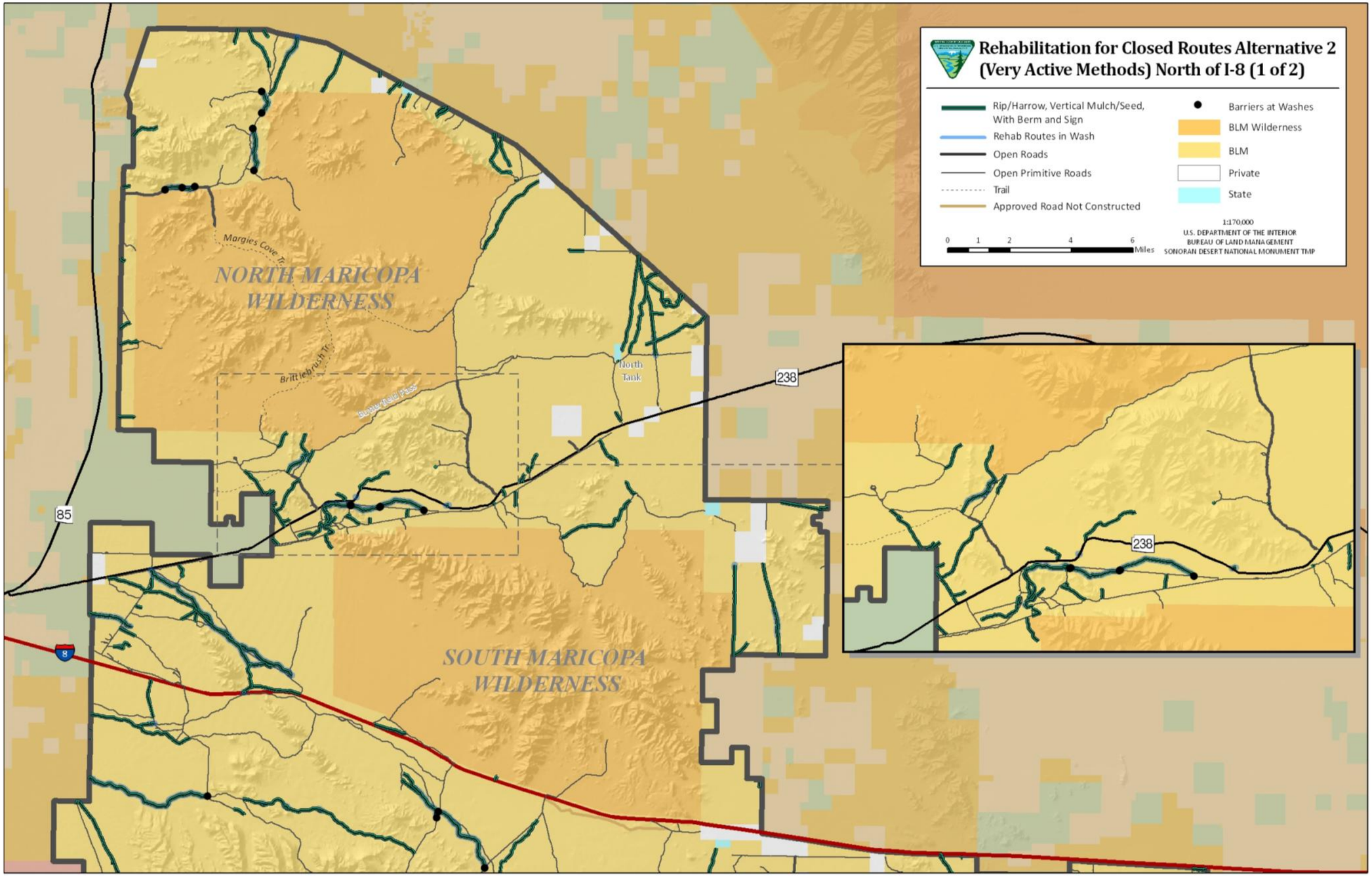
## ALTERNATIVE 2 – VERY ACTIVE APPROACH TO REHABILITATION METHODS

Alternative 2 proposes to implement the sign plan and conduct route rehabilitation by active mechanical methods that disturb the entire route bed and loosen compacted soils for better plant establishment. (See **Table 13**, Rehabilitation Methods by Miles for Alternative 2). A tractor towed disc harrow or a finger type ripper mounted on a tractor or bulldozer would be used on all closed routes. Skilled labor would be required; dirt berms would be created at the end of upland routes. Heavy duty barriers of the post and cable type could be installed at intersections with washes. Signing would occur throughout the SDNM in the same manner as described in Alternative 1.

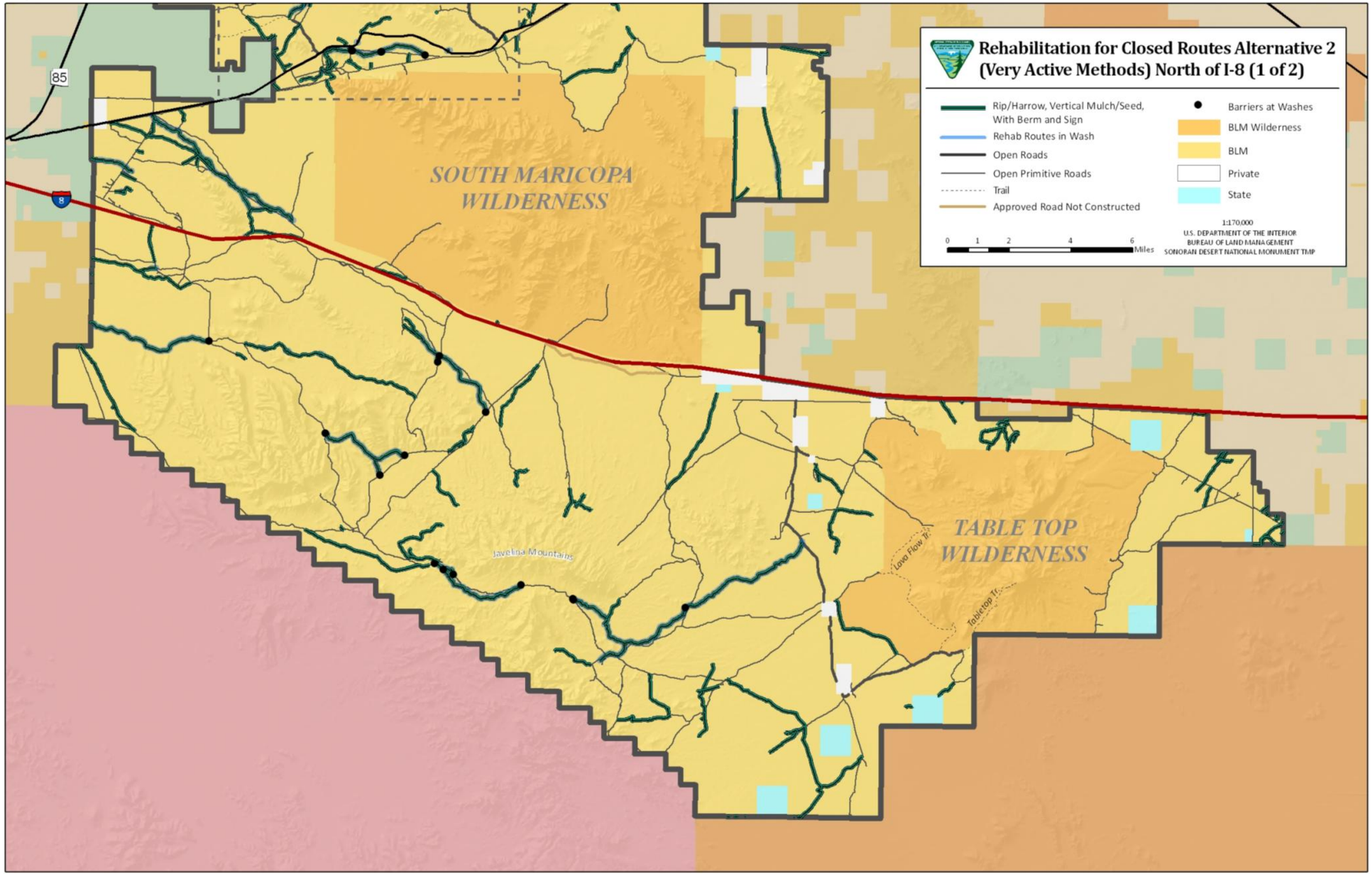
**Table 5. Rehabilitation Methods by Miles for Alternative 2**

| Rehabilitation Method | Miles | Miles in Wash |
|---|---|---|
| Rip/Harrow | 204.3 | 47.4 |
| | | |
| **Rehabilitation Method** | **Total Count** | **Number in Wash** |
| Barriers (Cutting off Wash Access) | 43 | 43 |

***Map 7. Rehabilitation for Closed Routes Alternative 2 (Very Active Methods) North of I-8***



**Map 8. Rehabilitation for Closed Routes Alternative 2 (Very Active Methods) North of I-8**



In this alternative, post and cable type or other metal structures will be the barrier of choice and would be employed in all wash routes being closed. In upland sites, a berm would be created to block access to closed routes. Closed signs would be installed at all locations.

### No Action Alternative

Under the No Action alternative BLM would not implement a comprehensive sign plan or the route rehabilitation actions necessary to comply with the RMP route designations. Routes would be allowed to decommission by passive, hands-off means and subsequent additional signing of open routes would not occur. Signs would be limited to those existing. Alternatives Considered but Removed from Detailed Analysis

BLM staff conceived an alternative for conducting closed route rehabilitation using only passive methods whereby all routes would be allowed to reclaim without intervention. The sign plan would be implemented as in other action alternatives. Benefits to using completely passive rehabilitation methods would come from the prevention of ground disturbing activities. On the surface, this appears to be beneficial to protecting Monument Objects, however, the prospect of routes rehabilitating with little active management, while being continually used, or even occasionally used, would be unlikely. Existing problems of erosion would continue unabated, likely adversely impacting monument objects. Therefore, this alternative was eliminated from further consideration.

# Affected Environment & Environmental Consequences

### Definition of Terms

Common terms used to describe potential environmental impacts are defined as follows:

**Adverse**: The effect is negative on a particular resource or a number of resources. *In this document, the term impact is assumed to be adverse unless otherwise stated.*

**Beneficial**: The effect is positive effects on a particular resource or a number of resources.

**Direct**: The effect which is caused by the action and occur at the same time and place.

**Indirect**: The effect which is caused by the action and is later in time or farther removed in distance, but still reasonably foreseeable. Indirect effects may include growth-inducing effects, and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on water and air and other natural systems, including ecosystems.

**Cumulative**: Effects that result from the incremental effect of an action when considered with other past, present, and reasonably foreseeable future actions.

**Negligible**: The effect is at the lower level of detection; change would be difficult to measure.

**Minor**: The effect might result in a slight but detectable change but would not be expected to have an overall effect.

**Moderate**: The effect would likely result in a measureable change and could have an appreciable effect.

**Major**: The effect would likely result in a substantial change.

**Short-Term**: The effect occurs only for a short-time (during construction) after implementation of the action.

**Long-Term**: The effect occurs for an extended period (more than 5 years) after implementation of the action.

## RESOURCES NOT AFFECTED BY PROPOSED ACTION

The following resources have been evaluated and they are either not present in the project area or it has been determined by resource specialists that based on current information they would not be affected by the proposed action.

Air Quality (see AP42 analysis and modeling completed in Air Quality Conformity Analysis, LSFO-SDNM PRMP/FEIS 2012)
Areas of Critical Environmental Concern
Floodplains
Invasive, Non-native species Minerals
Native America Religious Concerns
Prime or Unique Farmlands
Solid or Hazardous Wastes
Water Quality (Surface and Ground)
Wild and Scenic Rivers
Wild Horses and Burros

Many of the planned TMP components do not involve surface disturbance nor have effects to the human environment. For that reason, they are not analyzed further in this section. These include: Education and Information Messaging, Monitoring, Adaptive Management, Enforcement, Legal Public Access and Landowner Access. Engineering and Maintenance activities will be addressed through another environmental assessment.

# AFFECTED RESOURCES

## Soil Resources

### *Affected Environment*

There are over twenty different soil types in SDNM, however, only a few are affected by the rehabilitation actions proposed in alternatives. Signing would occur throughout the SDNM, but the effects are so wide spread and expected to be of such a minor footprint that they will not be considered in this discussion of soil types. **Table 14,** Soil Types Occurring in the Location of Closed Route Rehabilitation, displays the soil types in the project areas and their susceptibility to erosion.

**Table 6. Soil Types Occurring in the Location of Closed Route Rehabilitation**

| Soil Types in Project Areas for Route Rehabilitation | Overall Erosion Potential | Water Erosion Potential | Wind Erosion Potential |
|---|---|---|---|
| Carrizo-Momoli complex, 0 to 3 percent slopes | Not highly erodible land | Not highly erodible land | Not highly erodible land |
| Denure-Rillito-Why complex, 1 to 5 percent slopes | Highly erodible land | Not highly erodible land | Highly erodible land |
| Gunsight-Chuckawalla complex, 1 to 15 percent slopes | Not highly erodible land | Not highly erodible land | Not highly erodible land |
| Gunsight-Pinamt complex, 1 to 15 percent slopes | Not highly erodible land | Not highly erodible land | Not highly erodible land |
| Not Complete (Area A) | Varies | Varies | Varies |

Erosion can occur whenever there is insufficient cover or litter to shield soils from the effects of wind and water. Soils can be affected during rehabilitation projects in the short and long term. In the short term, soils may be disturbed by mechanical or manual means. When this occurs, wind erosion can carry soil away. Conversely, when not already stabilized, rain events can carry soils through concentrated flow. In both cases, the short term effect can be minimized by planning work times coincident with suitable soil or weather conditions such as adequate soil moisture, or low wind speed. In the long term, if soils are not stabilized, or crusted on top, such wind and water effects can become great, resulting in head cutting or gullying.

### *Impacts*

#### No Action Alternative

The effects of not conducting route rehabilitation would have the effect of continuing to lose soil through wind and water erosion due to closed routes lacking vegetative cover. Surface layers would be unlikely to stabilize due to the probability of continually being used by vehicles, regardless of designation status as closed. Soil loss would have a minor to moderate adverse effect over the long term due to the continuous effects of wind and water eroding the route bed, causing head cuts or gullies.

## Alternative 1 – (Passive)

**Table 15** displays the soil types in the rehabilitation areas, their acreage in these soil types and a rating of their erosion potential. Highlighted values represent soil types where caution would be necessary not to create large unstabilized areas during projects.

**Table 7. Soils in Rehabilitation Areas - Alternative 1 (Very Active Method)**

| **Rehab Method: Berm and Sign** | | | | |
|---|---|---|---|---|
| **Soil Type** | **Acres** | **Overall Erosion Potential** | **Water Erosion Potential** | **Wind Erosion Potential** |
| Denure-Rillito-Why complex, 1 to 5 percent slopes | 0.09 | Highly erodible land | Not highly erodible land | Highly erodible land |
| | | | | |
| **Rehab Method: Berm and Fence** | | | | |
| **Soil Type** | **Acres** | **Overall Erosion Potential** | **Water Erosion Potential** | **Wind Erosion Potential** |
| Not Complete (Area A not Surveyed) | 11.24 | N/A | N/A | N/A |
| Carrizo-Momoli complex, 0 to 3 percent slopes | 7.03 | Not highly erodible land | Not highly erodible land | Not highly erodible land |
| Gunsight-Chuckawalla complex, 1 to 15 percent slopes | 2.80 | Not highly erodible land | Not highly erodible land | Not highly erodible land |
| Denure-Rillito-Why complex, 1 to 5 percent slopes | 1.37 | Highly erodible land | Not highly erodible land | Highly erodible land |
| | | | | |
| **Rehab Method: Rake Out Tracks** | | | | |
| **Soil Type** | **Acres** | **Overall Erosion Potential** | **Water Erosion Potential** | **Wind Erosion Potential** |
| Carrizo-Momoli complex, 0 to 3 percent slopes | 3.05 | Not highly erodible land | Not highly erodible land | Not highly erodible land |
| Denure-Rillito-Why complex, 1 to 5 percent slopes | 2.65 | Highly erodible land | Not highly erodible land | Highly erodible land |
| Gunsight-Chuckawalla complex, 1 to 15 percent slopes | 2.97 | Not highly erodible land | Not highly erodible land | Not highly erodible land |
| Not Complete (Area A) | 1.35 | N/A | N/A | N/A |

| Rehab Method: Rip/Harrow | | | | |
|---|---|---|---|---|
| **Soil Type** | **Acres** | **Overall Erosion Potential** | **Water Erosion Potential** | **Wind Erosion Potential** |
| Carrizo-Momoli complex, 0 to 3 percent slopes | 0.92 | Not highly erodible land | Not highly erodible land | Not highly erodible land |

| Rehab Method: Sign | | | | |
|---|---|---|---|---|
| **Soil Type** | **Acres** | **Overall Erosion Potential** | **Water Erosion Potential** | **Wind Erosion Potential** |
| Carrizo-Momoli complex, 0 to 3 percent slopes | 3.08 | Not highly erodible land | Not highly erodible land | Not highly erodible land |
| Denure-Rillito-Why complex, 1 to 5 percent slopes | 1.16 | Highly erodible land | Not highly erodible land | Highly erodible land |

| Rehab Method: Sign and Fence | | | | |
|---|---|---|---|---|
| **Soil Type** | **Acres** | **Overall Erosion Potential** | **Water Erosion Potential** | **Wind Erosion Potential** |
| Carrizo-Momoli complex, 0 to 3 percent slopes | 9.70 | Not highly erodible land | Not highly erodible land | Not highly erodible land |
| Not Complete (Area A Not Surveyed) | 1.74 | N/A | N/A | N/A |
| Gunsight-Pinamt complex, 1 to 15 percent slopes | 1.43 | Not highly erodible land | Not highly erodible land | Not highly erodible land |
| Denure-Rillito-Why complex, 1 to 5 percent slopes | 1.08 | Highly erodible land | Not highly erodible land | Highly erodible land |
| Others < 1 acre | | | | |

| Rehab Method: Sign and Rake Out Tracks | | | | |
|---|---|---|---|---|
| **Soil Type** | **Acres** | **Overall Erosion Potential** | **Water Erosion Potential** | **Wind Erosion Potential** |
| Not Complete (Area A Not Surveyed) | 3.40 | N/A | N/A | N/A |
| Carrizo-Momoli complex, 0 to 3 percent slopes | 2.04 | Not highly erodible land | Not highly erodible land | Not highly erodible land |
| Others < 1 acre | | | | |

| Rehab Method: Sign and Rake Out Tracks | | | | |
|---|---|---|---|---|
| **Soil Type** | **Acres** | **Overall Erosion Potential** | **Water Erosion Potential** | **Wind Erosion Potential** |
| Carrizo-Momoli complex, 0 to 3 percent slopes | 0.25 | Not highly erodible land | Not highly erodible land | Not highly erodible land |

The types of rehabilitation would have negligible effects on the erosion prone Denure-Rillito-Why soil complex since the methods proposed would leave most of the route bed being rehabilitated as undisturbed. Only a sign, fence or berm would generally be placed at the beginning or end of the route, leaving the majority of the route to reclaim passively.

**Alternative 2 – (Very Active)**

**Table 16** displays the soil types in the rehabilitation areas, their acreage in these soil types and a rating of their erosion potential. Highlighted values represent areas where caution would be necessary not to create large, unstabilized areas during projects.

**Table 8. Soils in Rehabilitation areas - Alternative 2 (Very Active)**

| Rehab Method: Rip/Harrow, Vertical Mulch/Seed with Berm and Sign | | | | |
|---|---|---|---|---|
| **Soil Type** | **Acres** | **Overall Erosion Potential** | **Water Erosion Potential** | **Wind Erosion Potential** |
| Carrizo-Momoli complex, 0 to 3 percent slopes | 26.06 | Not highly erodible land | Not highly erodible land | Not highly erodible land |
| Not Complete (Area A) | 17.72 | N/A | N/A | N/A |
| Denure-Rillito-Why complex, 1 to 5 percent slopes | 7.02 | Highly erodible land | Not highly erodible land | Highly erodible land |
| Gunsight-Chuckawalla complex, 1 to 15 percent slopes | 6.72 | Not highly erodible land | Not highly erodible land | Not highly erodible land |
| Gunsight-Pinamt complex, 1 to 15 percent slopes | 1.44 | Not highly erodible land | Not highly erodible land | Not highly erodible land |

The types of rehabilitation would have minor to moderate adverse effects on the erosion prone Denure-Rillito-Why complex since the methods proposed would affect most of the route bed being rehabilitated, creating areas of silt beds. To avoid soil loss, earth work would need to be conducted at the sufficient soil moisture content, which would be difficult to plan.

## Cultural Resources

### *Affected Environment*

At least 190 cultural resource studies have been completed within the public lands in the SDNM. This translates to 6.2 percent of the area of public lands in the SDNM have been inventoried for cultural resources. These studies have identified and documented 291 cultural sites on the public lands within the Monument. Roughly 77% of these sites can be attributed to aboriginal use of the area. About 4% have a mixture of historic period and aboriginal components. Estimates add up to 13 % of the sites having historical Euro-American period, and 7% have not been determined temporally or culturally. This information was drawn from the *Draft Cultural Resource Overview for the Phoenix South and Sonoran Desert National Monument* (2005), by URS. A discussion of the culture history of the area is available in the RMP, in Section 3.2.4, Cultural and Heritage Resources.

A variety of site types have been identified on the SDNM through different inventory projects. Although this is not a comprehensive list of surveys performed, it gives a sense of the types of sites and the density of them. Site types include: habitations, petroglyphs, lithic quarries, artifact scatters, mines, mining camps, ranching sites, trash dumps, village sites, historic trash scatters, historic railroad construction and maintenance sites, and historic homestead sites.

Homburg, Altschul, Vanderpot (1994) inventoried a habitation, rock shelters, hunting blinds, rock art, lithic quarries, lithic scatters, ceramic scatters, and artifact scatters, mines, mining camps, prospector's camps, ranching sites, military sites, and trash dumps. This survey covered a total of 15,000 acres. 130 new cultural sites were recorded. The extensive block surveys included segments of many routes discussed in this Travel Management Plan Environmental Assessment.

In 2007, Shirley and Grant surveyed a combined total of 258 acres. This survey of 45 miles of routes and three block survey areas resulted in the recordation of 13 new sites. These included village sites, hamlets, a multi-component site with prehistoric village and a standing historic house, a multi-component site with prehistoric artifact scatter and historic mining claim, an artifact scatter, and a mining complex.

A total of 12 new sites were recorded by Bungart and Raney in 2007, during their inventory of 1,477 acres on the SDNM. The survey was concentrated along certain routes in order to ascertain impacts. This work resulted in the identification of artifact scatters, petroglyphs, and a stone circle.

In 2002, Blanchard and Sullivan surveyed along a 14-mile stretch of Vekol Road. Surveyors observed a number of artifact scatters, a historic trash scatter, and a small village or hamlet. This inventory resulted in the recordation of 15 sites on a total of 1,496 acres.

Cultural surveys have been performed along some of the routes proposed for rehabilitation. Those routes that have not been inventoried will be prioritized for cultural resource surveys as funding is available. According to AZ Site data, 19 sites occur in proximity to the rehabilitation project areas. Inventory to identify cultural resources that may be affected by the proposed activities will be conducted prior to the initiation of any surface disturbing activities.

### *Impacts*

Overview

Cultural resources may be affected by the variety of activities proposed in this action. It is therefore important to assure the identification of any cultural sites present through the performance of inventory in the affected areas, when projects are proposed. All identified sites would be evaluated for their potential eligibility for listing on the National Register of Historic Places (NRHP). Proposed activities will be designed to avoid impact to cultural sites eligible for listing on the NRHP and to implement measures to reduce or minimize the effects. If any rehabilitation activity cannot be redesigned or minimized on an NRHP eligible site, it could result in an adverse effect on the site. This would prompt the development and implementation of a treatment plan for mitigation of these effects.

Methods of Analysis

Section 4.5.1 in the RMP contains a discussion on the methods of analysis used to assess impact. The assessment of impacts on cultural resources is based on specific indicators that are applied. Cultural resources are evaluated for their integrity of location, design, setting, materials, workmanship, feeling, and association. This list of indicators describes many of the most common types of impacts on cultural resources that may diminish or destroy integrity.

Indicators of contextual elements:

- Site features or arrangement of artifacts and features disturbed.
- Artifacts missing or rearranged.
- Site elements rearranged.
- Ground surface disturbed.
- Sub-surface cultural deposits disturbed, and
- Impacts on site setting/visual integrity:
    - Damage to physical environment of site
    - Damage to historic sense of a particular period of feeling of site's context.

Assumptions

Ground- and surface-disturbing activities can vary. Ground-disturbing activities from mechanical and vehicular sources are assumed to have the potential to impact cultural resources by damaging features, crushing or compacting subterranean features, rearranging features, pushing soils to remove or excavate the original surface, or disturbing the contextual arrangement of features and artifacts.

Natural processes, such as erosion or weathering, degrade the integrity of many types of cultural resources over time. Human visitation, recreation, OHV use, livestock grazing, fire and non-fire vegetation treatments, and other activities can increase the rate of deterioration through natural processes. While the effect of a few incidents may be negligible, the effect of repeated actions or visits over time is likely to intensify impacts.

Vandalism or unauthorized collecting can destroy cultural resources in a single incident. Increased access to areas where cultural resources are present can raise the risk of vandalism or unauthorized collection of cultural resources.

**No Action Alternative**

If certain routes are not closed with a physical barrier, vehicles would continue to use these access routes and areas. This would likely to lead to direct and indirect impacts to sites. If rehabilitation is not done, routes will continue to be used by the public, even though they were selected to be closed. There are some routes that were selected for closure due to their conflicts with cultural sites, if these routes are not closed with barriers or rehabilitated, impacts would likely continue or increase in volume and intensity.

**Alternative 1 - (Passive)**

If low impact techniques and reduced mechanized use of equipment are used for rehabilitation, cultural resource identification and evaluation would be required on only those areas proposed for surface disturbing work. As compared to the No Action alternative, the possibility of disturbing undiscovered resources is higher. The list of indicators and assumptions outlined previously would apply. When cultural resources are identified and evaluated as having the characteristics that would make them eligible for the NRHP and they lie with the Area of Potential Effect (APE), the project would be redesigned to avoid, reduce, or minimize the effects. Therefore, some forms of minimal rehabilitation activities would need to be redirected from NRHP eligible sites. If these activities cannot be redirected or redesigned, the result may be an adverse effect on the site. This would prompt the development and implementation of a treatment plan for mitigation of these effects. Completing the rehabilitation of closed routes by lower impact methods would have a generally beneficial effect of preventing continued driving in areas where parking for vandalism and/or looting might occur.

**Alternative 2 - (Very Active)**

If mechanized techniques and equipment are used for rehabilitation, cultural resource identification and evaluation would be required on all areas proposed for this work. The list of indicators and assumptions would apply that are expressed above, under Alternative 1.

The application of mechanized techniques would include a ripping tool capable of penetrating the ground surface to a depth of two feet and loosening the surrounding ground as it is pulled. A disc harrow would penetrate the ground surface and turn the earth over in chunks up to eight inches deep. A tine rake would scarify the ground surface and disturb surface deposits,

primarily. All of these methods would disturb cultural site surface and / or sub-surface features, artifacts, context, and arrangement of site attributes. A total of 19 sites are known to be present in these project areas.

Placement of barriers in closed wash routes would occur in proximity to 4 known sites. Survey and cordoning off of areas prior to beginning work would ensure avoidance or a treatment would be devised to avoid adverse effects to this Monument object.

When cultural resources are identified and evaluated as having the characteristics that would make them eligible for the NRHP and they lie with the Area of Potential Effect (APE), the project would be redesigned to avoid, reduce, or minimize the effects. Therefore, highly mechanized rehabilitation activities would be redirected from NRHP eligible sites. If these activities cannot be redirected or redesigned, the result would have an adverse effect on the site. This would prompt the development and implementation of a treatment plan for mitigation of these adverse effects.

## Special Designations: Juan Bautista de Anza National Historic Trail

### *Affected Environment*

The Juan Bautista de Anza National Historic Trail (NHT) is a 1,200-mile historic trail corridor commemorating the 1775-1776 land route that Spanish commander Juan Bautista de Anza followed from Mexico through Arizona to California in an effort to establish a mission and presidio on San Francisco Bay. A segment of this trail corridor cuts through the mid-section of the SDNM. Although this trail has no known surviving trail signature on the ground, the diaries and journals allowed historians to determine the alignment of the corridor. The corridor was designated by Congress in 1990 as a part of the National Trails System.

Conservation of the natural visual setting along the trail corridor and constructing a recreational retracement route for non-motorized use are two important objectives. In the "Comprehensive Management and Use Plan Final Environmental Impact Statement for the Juan Bautista de Anza National Historic Trail" (NPS 1996) (Anza CMP), the nature and purpose of the trail is to create a vicarious experience for the visitor through the interpretation and preservation of significant trail resources.

On the SDNM, the Juan Bautista de Anza National Historic Trail Management Area has been designated in the RMP. This segment of the NHT through the SDNM qualifies as a "high potential route segment" since it would afford a high quality recreation experience.

An expanded discussion about the NHT can be found in the RMP, in section 3.4.2.2. and in section 2.12.3.

### *Impacts*

The Juan Bautista de Anza NHT may be affected by the activities proposed in this EA. These activities may impact the natural visual setting or interfere with the nature and purpose of the trail. Section 4.18.1 in the RMP contains a discussion on the methods of analysis used to assess impacts.

Assumptions

Before the BLM may authorize any project with potential to affect cultural resources, law and regulation require that the agency conduct site-specific inventory, evaluate potentially impacted sites for National Register of Historic Places eligibility, and stipulate measures to reduce effects, as necessary. Impacts may be reduced by avoidance or mitigation measures, such as data collection or project redesign. Vandalism or unauthorized collecting can destroy historic trails and associated cultural resources in a single incident. Exposure or access to areas where these resources are present can increase the risk of vandalism or unauthorized collection of artifacts. Assumptions are the same as the Cultural Resources section above.

Impact Indicators:

Damage to the arrangement or structure of features

- Artifacts missing or rearranged
- Site or historic trail elements re-arranged
- Ground surface disturbed
- Subsurface cultural and historic deposits disturbed and/ or re-arranged
- Damage to physical environment of historic trail and/or associated cultural site
- Damage to historic sense of a particular period of time or feeling of historic trail or associated site's context
- Changes to the landscape settings, to the level that historic trail and associated site values are diminished.

**No Action**

If areas of the routes are neither rehabilitated nor have a barrier installed, compliance by the vehicle-using public will not be realized. Vehicles would continue to be used on routes that were scheduled for closure. Routes would continue to be used, which would increase the likelihood that impacts to NHT values would increase in volume and intensity over time.

**Alternative 1 – (Passive)**

If low use mechanized techniques and equipment are used for rehabilitation, cultural resource identification and evaluation would be required on only those areas proposed for surface disturbing work. As compared to the No Action alternative, the possibility of disturbing undiscovered resources is higher. The list of indicators and assumptions would apply to NHT values that are expressed above, under Alternative 1. When cultural resources are identified

and evaluated as having the characteristics that would make them eligible for the NRHP and they lie with the Area of Potential Effect (APE), the project would be redesigned to avoid, reduce, or minimize the effects. Therefore, some forms of rehabilitation activity would need to be redirected from NRHP eligible sites. If these activities cannot be redirected or redesigned, the result would be an adverse effect on the site. This would prompt the development and implementation of a treatment plan for mitigation of these effects.

**Alternative 2 – (Very Active)**

If mechanized techniques and equipment are used for rehabilitation, the same cultural resource identification and evaluation would be required on all areas proposed for this work. The list of indicators and assumptions would apply to national trail values that are expressed above, under Alternative 1.

The application of mechanized techniques would include a ripping tool, that is capable of penetrating the ground surface to a depth of two feet and ripping the ground as it is pulled. A disc harrow would penetrate the ground surface and turn the earth over in large chunks. A tine rake would scarify the ground surface and disturb surface deposits, primarily. All of these methods would disturb NHT-related cultural site surface and/or sub-surface features, artifacts, context, and arrangement of site attributes.

When cultural resources are identified and evaluated as having the characteristics that would make them eligible for the NRHP and they lie with the Area of Potential Effect (APE), the project would be redesigned to avoid, reduce, or minimize the effects. Therefore, highly mechanized rehabilitation activities would need to be redirected from NRHP eligible sites. If these activities cannot be redirected or redesigned, the result would be an adverse effect on the site. This would prompt the development and implementation of a treatment plan for mitigation of these effects.

Areas within the NHT corridor and/ or within the Management Area that are found to be outside of a physical cultural site may not experience impacts to NHT values in the same way as a cultural site. Highly mechanized rehabilitation may allow for soil and vegetation conditions to be restored to a condition resembling its historic one.

## Wildlife Resources

### *Affected Environment*

General wildlife species of the project area include, but are not limited to; desert mule deer (*Odocoileus hemionus*), black-tailed jackrabbit (*Lepus californicus*), coyote (*Canis latrans*), round-tailed ground squirrel (*Spermophilus tereticaudus*), red-tailed hawk (*Buteo jamaicensis*), turkey vulture (*Cathartes aura*), white-winged dove (*Zenaida asiatica*), Gambel's quail (*Lophortyx gambelii*), desert iguana (*Dipsosaurus dorsalis*), zebra-tailed lizard (*Callisaurus draconoides*), western whiptail (*Aspidoscelis tigris*), and diamondback rattlesnake (*Crotalus atrox*). A more expansive

listing of species and descriptions of habitat condition and needs can be found in the SDNM Final RMP in sections 3.2.13.3 and 3.2.13.4.

Sonoran desert tortoise

A species of particular interest in the project area is the desert tortoise (*Gopherus agassizii*). There is approximately 166,000 acres of Category I, 124,700 acres of Category II and 3,500 acres of Category III desert tortoise habitat allocated and occur within the monument. The total tortoise habitat within SDNM is 294,200 acres out of 486,400 acres in the SDNM. Tortoise habitat is associated with bajadas, rough, rocky slopes, and ridges. Tortoises also use caliche caves in washes for burrows as well as washes as travel ways.

Desert bighorn sheep

Approximately 290,411 acres of Desert bighorn sheep habitat lies within the monument. Desert bighorn have been documented from all the mountain ranges on the SDNM. Important features of Desert bighorn habitat are cliffs, rock outcrops, and talus slopes which are used as escape terrain. Desert bighorn are closely associated with Paloverde mixed cacti-mixed scrub on Rocky slopes, mountain upland and rock outcrop natural communities. However, desert bighorn sheep move seasonally between the uplands and bajadas and also travel across desert valleys between mountain ranges. Recent population estimates for the Sand Tank, North and South Maricopa Mountains have been low, presumably due to severe drought conditions over the past several years.

Lesser long-nosed bat

The Lesser long-nosed bat was listed, as endangered, in September, 1988 without critical habitat (USFWS 1988). The lesser long-nosed bat consumes high energy nectar, pollen and fruit produced by a variety of columnar cacti and agaves. The migratory nature of the lesser long-nosed bat allows it to take advantage of the seasonal availability of these cacti and agave species. Cactus flowers and fruit are available during the spring and early summer; agave flowers are available from July through October.

Tucson shovel nosed snake

The Tucson shovel-nosed snake is a nocturnal animal that burrows in loose sand by "sand swimming" (wriggling through sand rather than tunneling) (Stebbins 1985). Little is known about the specific habitat needs of this subspecies, but because of its burrowing habits, the shovel-nosed snake is found in areas with soft sandy loams, loose soil, fine, wind-blown sands, such as in washes, or occasionally on rocky hillsides with pockets of sand among rocks (Stebbins 1985). There are two known occurrences of the snake one along I-8 (to the east of the monument) and the other along Highway 85, west of the monument. Both occurrences are outside of the monument boundary. It can be assumed that the snake does occupy areas of the monument where habitat is conducive for the needs of the species.

### *Impacts*

**No Action Alternative**

Under the no action alternative it can be assumed that the closed routes would continue to be utilized by OHVs and other public and the areas where wildlife species such as bighorn sheep, are present could become avoidance areas in the event that such use disrupts species lifecycles.

Sonoran desert tortoise can be directly impacted by off-highway vehicles from road kill, interruption of tortoise movements, and removal as pets, and indirectly from impacts to vegetation used for cover and forage, and fragmentation of contiguous areas of vegetative habitat.

Tucson shovel nose snake mortality is unknown but it is expected that mortality would remain at essentially the same levels as current level due to likelihood of closed routes to be used in their creosote-bursage flat habitat.

It can be assumed that foraging habitat for the Lesser long-nosed bat would continue to be affected at current levels. Indirectly mortality of cactus pups and nurse plants could continue under the no action alternative.

**Alternative 1 – (Passive)**

Impacts to general wildlife species would range from negligible to minor under the proposed action. Ripping/harrowing of upland locations could impact wildlife during construction activities and would be short term in nature. Wildlife could avoid the area that is under rehabilitation dependent on location and amount of human activity and noise associated with the project. However, once the project is completed it can be assumed that wildlife would return to the area. Some small slow moving animals and small burrows could be destroyed or removed as construction activities are conducted; however, this would not lead to decreases in local species populations as a whole. The action of restoration through natural vegetation would have no effect on species in the area. Natural restoration processes would occur without human presence or construction activities. However, due to routes remaining in place and existing soil compaction, vegetation could take longer to regenerate or reoccupy the area.

Decommissioning routes within the SDNM could benefit the tortoise due to the expected reduction of human activity. This would allow the tortoise to forage, travel, and move and breed around and near the areas of route closure with no impediments from human activity. The proposed ground disturbing actions would have a negligible impact to the Sonoran desert tortoise in the short term until disturbed areas are rehabilitated. Acres of tortoise habitat returned to productivity by rehabilitation activities are shown in **Table 17** below. Comparative to the total acres of tortoise habitat existing in SDNM, the short term negative effects and long term benefits would both be minor, representing only 0.8% of the total tortoise habitat in SDNM.

**Table 9. Sonoran Desert Tortoise Habitat Acres Returned Productivity**

| Habitat Class | Miles Closed | Avg Route[1] Width (ft) | Ft/Mile | Total Sq/Ft | Sq Ft/Ac | Acres |
|---|---|---|---|---|---|---|
| Category 1 | 59.1 | 12 | 5,280 | 3,747,110.4 | 43,560 | 86.0 |
| Category 2 | 83.8 | 12 | 5,280 | 5,311,468.8 | 43,560 | 121.9 |
| Category 3 | 5.4 | 12 | 5,280 | 344,678.4 | 43,560 | 7.9 |
| Total all habitat categories | | | | | | 215.9 |

[1] All routes being closed are primitive roads

Route decommissioning within the SDNM could have beneficial effects to the species by removing OHV activity and allowing bighorn sheep to travel, move, forage, breed and kid near and around the areas of route closure without disruptions from human activity. The proposed action would have a negligible impact to bighorn sheep as a result of the improved habitat conditions and reduced opportunity for human interaction.

Potential conflicts between OHV use and Lesser long-nosed bat foraging habitat may include an increase in non-native plant species, which could result in an increase in fire frequency in the Sonoran desert. Other potential conflicts include soil compaction, squishing of young saguaro, and crushing/destruction of saguaro nurse plants. The proposed action would have a negligible impact to Lesser long-nosed bat resulting from the temporary nature of the disturbance and the long term improvements to both vegetation and visitor management. Mature saguaros and other columnar cactus would be unaffected during signing and rehabilitation actions having no effect on foraging of the bat.

Potential conflicts between OHVs and Tucson shovel-nosed snakes could result from soil compaction, accidental vehicular mortality and the alteration of vegetative communities through the introduction of non-native plant species. The proposed signing and rehabilitation actions would have a negligible impact to Tucson shovel-nosed snake in the short and minor beneficial effect in the long term due to activities subsiding in disturbed areas where snakes could be present. Night time work would be avoided, thus having no road kill effect on snakes. Considering that 50% of the rehabilitation, 101.6 miles, is to occur in creosote-bursage vegetation community, this species is likely to benefit from reduced presence of roads over the long term.

## Alternative 2 - (Very Active)

Impacts to wildlife would be similar to those in proposed action, except that this alternative would increase the amount of surface disturbance and human activity in the short term. The increase in surface disturbance, being a more intense action than the No Action or Alternative 1, including increased human activity could lead to species avoiding areas for extended periods of time and occupying other available habitats in the immediate area. This alternative could increase the likelihood of some small slow moving animals and small burrows being destroyed

or removed as construction activities are conducted, however this would not lead to decreases in local species populations as a whole. Effects overall would be minor to negligible in the long term.

## Vegetation Resources

### *Affected Environment*

In the areas affected by the rehabilitation action, there are six different vegetation communities, all of which are associated with Monument objects. The vegetation community acreages in SDNM are shown in **Table 18**.

**Table 10. Vegetation Community Acreage Table**

| Vegetation Community | Acres |
|---|---|
| Creosote-Bursage | 179,600 |
| Palo Verde-Mixed cacti | 303,300 |
| Other (incl. desert wash) | 3,500 |
| Total | 486,400 |

Project areas for include 47.4 miles of desert washes containing stands of mature trees such as Palo verde, ironwood and mesquite. Activities that cause damage to vegetation communities include those that denude areas, compact soils to prevent root penetration or allow invasive species to proliferate.

### *Impacts*

#### No Action Alternative

There would be continuing impacts to vegetation communities through continued loss of vegetation from camping, vehicle parking and driving. A lack of maintenance would continue the practice of driving around bad spots, thus causing additional vegetation loss along roads and primitive roads. Roads designated as closed would likely not rehabilitate in a short enough time to prevent them from being continually used and restoration would not be achieved.

#### Alternative 1 – (Passive)

Using lower impact techniques for route rehabilitation would have a minor effect on short term growth of all types of vegetation. As compared to the No Action alternative, growing conditions would be improved due to the presence of barriers and signage to prevent vehicle use leading to soil compaction. In the long term, effects would be minor, yet beneficial, in returning areas to productivity and large swaths of land would be undisturbed.

**Table 11. Vegetation Communities Acreage Affected**

| Vegetation Community | Closed Route Miles | Affected Acres (12 ft Avg. Width | Percent of Project Area |
|---|---|---|---|
| Sonoran Paloverde-Mixed Cacti Desert Scrub | 98.1 | 142.6 | 48.4 |
| Sonora-Mojave Creosote bush-White Bursage Desert Scrub | 101.6 | 147.8 | 50.1 |
| Other – combined (including desert wash) | 3.1 | 4.6 | 1.5 |

Rehabilitation activities could disturb up to 1.3 acres of previously undisturbed area along project areas due to parking or other activities associated with this work. This is based on an assumption that 5% of a 10 foot buffer zone along project areas using heavy equipment (i.e. ripping) would be impacted.

Installing new portal signage and delineation of pull off areas where visitors park to read information boards would disturb up to 6 acres of new area throughout SDNM, having a negligible effect on long term productivity of any of the vegetation communities.

Conducting vertical mulching activities would have the short term effect of reducing vegetation density along either side of the route being rehabilitated due to the moving of small live cacti such as barrel cactus, trimming of cactus limbs such as prickly pear and staghorn cholla and shrubs into the route bed. The long term effect would be an increase in production for the entire area.

Desert washes would generally increase in vegetation density. Strata would improve resulting from a lack of vehicles passing, whereby plants and trees could grow without injury.

The rehabilitating routes would occur in the two major vegetation communities and four other smaller communities, including desert washes, and have the effect of returning 295 acres to productive plan communities throughout SDNM. Rehabilitation project area would occurring in Palo verde-mixed cacti community are attributable to 0.05% of the total acres in SDNM. In Creosote-Bursage community, the project area would cover 0.06% of the total acres in SDNM. Due to the low amount of new and existing acres disturbed, the rehabilitation action would have a negligible effect on this resource.

**Alternative 2 - (Very Active)**

Using high impact methods for rehabilitation would reduce recovery time and possibility increase recruitment of high value plants, trees and cacti due to increased rooting depth potential. All existing vegetation in the path of ripping or harrowing would be removed, having a moderate short term effect on the percent of cover in project areas. In the long term, acres returned to full productivity would be the same as Alternative 1. The potential for proliferation of invasive weeds is greater than alternative 1 or the No Action Alternative. Acres of disturbed area from rehabilitation activities, as compared to the No Action and Alternative 1, would

increase due to greater use of equipment to rip each and every route, however the level of disturbance would still remain low considering the small work area relative to SDNM, thus effects would be negligible. Effects to desert washes would be the same as Alternative 1, although rehabilitation of strata would occur sooner resulting from better protection from vehicle related impacts

## Wilderness Characteristics

### *Affected Environment*

Inventories for wilderness characteristics were conducted by BLM between 2003 and 2012. BLM assessed the SDNM for wilderness characteristics as part of the land use planning process, in response to input received during scoping, and in response to public comments provided on the draft LSFO/SDNM land use plan. The following is a description of six areas within the SDNM, totaling 154,849 acres, determined to possess wilderness characteristics. Three areas totaling 107,800 acres, including Blue Plateau, Javelina Mountain and White Hills, will be managed to protect their wilderness characteristics:

Blue Plateau (Sand Tank Mountains West): This large and natural area has wilderness characteristics as documented in BLM's 2004 and 2011 wilderness characteristic assessments.

Butterfield Stage Memorial: The unit retains borderline wilderness characteristics as documented in BLM's 1980 wilderness inventory and 2011 re-assessment. The area, however, is less natural than documented in 1980 due to impacts on naturalness from OHV use, trail and route creation, campsite proliferation, and damage to plants and rocks from target shooting.

Javelina Mountain (Sand Tank Mountains East): This large area is natural and has outstanding wilderness characteristics as documented by BLM's 2004 and 2011 wilderness characteristic assessments.

Margie's Peak: Outstanding opportunities are present for solitude and primitive and unconfined recreation, but these opportunities are limited to small areas and restrained to some degree by the unit's size and location.

South Maricopa Mountain Wilderness Extension: The area retains wilderness characteristics as documented in BLM's 1980 intensive wilderness inventory and the 2011 inventory re-assessment.

White Hills: The unit is near-pristine in character and possesses wilderness characteristics as documented by BLM's 2004 and 2011 wilderness field inventory assessments. Long vegetation-lined desert washes and groupings of rolling disarrayed hills offer outstanding opportunities for solitude and primitive and unconfined recreation.

**No Action**

Current management would continue under No Action. Motorized vehicle use could persist on closed vehicle routes into the foreseeable future, preventing natural restoration through non-use. Impacts on wilderness characteristics from the sights and sounds of motorized travel could continue indefinitely. Closed vehicle routes would not be reclaimed through natural processes (weathering) or active mechanical reclamation. Consequently, wilderness characteristic landscapes would be less natural as these vehicle routes would not reclaim and potentially still be subject to varying levels of motorized recreation use. These impacts would occur in both areas allocated and not allocated to protect wilderness characteristics.

**Alternative 1 – (Passive)**

Alternative 1 would apply mainly passive (signing, education, minor raking) closure techniques on closed vehicle routes within the six SDNM areas allocated and not allocated to protect wilderness characteristics. The emphasis under this alternative would lean toward less-intensive and hands-off reclamation methods with limited to no surface disturbance.

Signing, user education, and some minor hand tool restoration of 71.4 miles of primitive vehicle route would, over the long-term, contribute to the protection of wilderness characteristics by reducing motorized recreation use within the six areas with wilderness characteristics. These actions would slightly and directly increase natural conditions on 104 acres of area directly impacted by the presence and use of the vehicle routes, while indirectly increasing a visitor's perception of naturalness and their solitude opportunities on 11,424 acres adjacent to the closed vehicle routes.

The sights and sounds of motorized recreation activities on closed routes within the Blue Plateau area, Javelina Mountain area and the White Hills area, three areas allocated to the protection of their wilderness characteristics, would be gradually inhibited upon the signing and closure of vehicle routes, based on the compliance of visitors with the passive closure measures. These areas have 62.5 miles of closed vehicle route, so in aggregate the impact would be gradually noticeable. Moreover, desert washes within these three areas that are not part of an approved route system would be immediately signed and closed. These drainages would naturally and quickly reclaim during seasonal flash floods. Overall, natural conditions and opportunities for solitude and primitive and unconfined recreation on about 10,000 acres surrounding the closed vehicle routes would be enhanced over the long term.

As described in the paragraph above, the sights and sounds of motorized recreation activities on closed routes within the Butterfield Stage Memorial, South Maricopa Mountains Extension and Margie's Peak areas, three areas not allocated to the protection of their wilderness characteristics, would also be gradually curtailed. Overall, the effects would be dependent on the compliance of visitors with the passive closure measures. The overall effects on wilderness characteristics would proportionally be much less as these three areas have less than nine miles of closed vehicle route.

Passive reclamation techniques like signing and raking would have less direct impact on the wilderness characteristic of naturalness over the short term since ground disturbances would be minimal, but with the concession that motorized use might continue for longer periods of time on vehicle routes not aggressively reclaimed or closed. Consequently, vehicle routes may not reclaim naturally for decades and motorized uses might continue, diminishing wilderness characteristics and the associated non-motorized recreation settings in areas neighboring the closed vehicle routes. It may take 20 or more years for primitive roads to naturally reclaim when only passive or natural reclamation techniques are applied. Wilderness characteristic protection and enhancement would not occur or would be achieved much slower under this alternative.

In summary, this alternative embodies moderate protective enhancement for lands with wilderness characteristics, both within lands allocated and lands not allocated, to protect wilderness characteristics. Overall, the naturalness of six areas could be slightly too moderately enhanced by the passive reclamation actions proposed. However, overall success under this alternative over the long term would mainly be correlated with the visitor's volunteer compliance with the subject route closures.

**Alternative 2 – (More Active)**

This alternative would apply a combination of passive (signing, education) and more aggressive mechanical (fencing, berming, barriers, harrowing, ripping, vertical mulching) reclamation techniques on closed vehicle routes within the six areas allocated and not allocated to protect wilderness characteristics. More active mechanical reclamation processes and vehicle barriers would be directly applied on routes when more passive reclamation measures fail to work or are unlikely to quickly achieve desired route restoration conditions both in the short and

Signing, closure and decommissioning of over 71.4 miles of primitive vehicle route would, over the long-term, contribute to the protection of wilderness characteristics in the six areas by directly escalating the natural character of the landscape over 104 acres, enhancing an individual's perception of naturalness, increasing opportunities for non-motorized primitive and unconfined recreation, and curtailing motorized use in areas allocated and not allocated to protect wilderness characteristics. Wilderness characteristics would also be improved and maintained in 11,424 acres of land surrounding these closed vehicle routes.

The sights and sounds of motorized recreation activities on closed routes within the Blue Plateau area, Javelina Mountain area and White Hills area, three areas allocated to the protection of their wilderness characteristics, would be quickly inhibited upon the signing and closure of vehicle routes, based on the active closure and removal closure measures. These areas have 62.5 miles of closed vehicle route, so in aggregate the impact would be immediately noticeable. Moreover, desert washes within these three areas that are not part of an approved route system would be immediately signed and closed. These drainages would naturally and quickly reclaim during seasonal flash floods. Overall, natural conditions and opportunities for

solitude and primitive and unconfined recreation would be directly enhanced on 91 acres and indirectly improved on 10,000 acres surrounding the closed vehicle routes. Natural conditions would be more rapidly achieved over both the short and long terms.

Where aggressive reclamation techniques are applied, results and desire outcomes would be quickly achieved. Wilderness characteristic protection and enhancement would occur faster in areas where vehicle routes are decommissioned with aggressive hand crew and mechanical reclamation techniques like vertical mulching, harrowing, or road bed ripping, along with combinations to dress and contour the mechanical reclamation work. The application of active mechanical reclamation techniques like mulching, ripping or harrowing would disturb soils and harm and kill plants, contributing to short-term effects on naturalness. Such activities would also create short-term impacts on solitude opportunities, lasting one to four weeks, from the sights of sounds of work crews and machinery. On-the-other-hand, vehicle routes would be eradicated and natural conditions restored more quickly in landscapes with aggressive mechanical reclamation techniques, as well as the near instantaneous potential of fewer vehicle incursions.

About nine miles of closed vehicle routes would also be decommissioned in Margie's Peak, the South Maricopa Mountains Extension, and the Butterfield Stage Memorial, areas not allocated to protect wilderness characteristics. Decommissioning routes in these three areas would enhance the documented wilderness characteristics as the landscapes would become more natural over the long term and potentially more available for non-motorized recreation activities like hiking, hunting and backpacking.

In summary, this alternative quickly achieves protective enhancement for lands with wilderness characteristics, both within lands allocated and lands not allocated, to protect wilderness characteristics. Overall, the naturalness of up to 104 acres would be directly reclaimed by the active decommissioning actions proposed under this alternative, and the perception of wilderness characteristics improved on the 11,424 acres flanking the closed vehicle routes.

# CUMULATIVE ACTIONS

**Table 12. Cumulative Actions: Past, Present and Future Actions**

| Action | Description | Resources Affected | Impact Area |
|---|---|---|---|
| Past (since 1912) | Increase in Arizona population, leading to increased road building /associated impacts in SDNM and surrounding areas. | All Monument objects (-), recreation (+/-) | Entire state, long term beginning at statehood |
| Present | Designation of routes in SDNM, resulting in 35% closure of existing routes. | All Monument objects (+) plus recreation (+/-), air quality (+) | SDNM area immediate connecting area |
| Present | Improvement of travel management in SDNM such as licensing requirements. | All Monument objects (+) plus recreation (+) | SDNM area immediate connecting area |

| Action | Description | Resources Affected | Impact Area |
|---|---|---|---|
| Future (5-10yrs) | Designation of routes on public lands outside SDNM. | Recreation including OHV (+/-), wildlife (+), wilderness characteristics (+), lands & realty (-), cultural (+), air quality (-) | Southwestern AZ |
| Future (5+ years) | Population increase leading to increased visitation in SDNM from adjacent towns by vehicle. | All Monument objects (-), recreation (-), air quality (-) | SDNM area immediate connecting area |
| Future (5+ years) | Increases in technology (i.e. alt. fuel vehicles, remote sensing technology) leading to better monitoring, resource conditions and lower impact use and management. Greenhouse gas emissions affected. | All Monument objects (+), recreation (+), air quality (+) | Southwestern AZ |

Cumulative effects to SDNM resources and objects began around the time of Arizona statehood in 1912. The continuous flow of people into the state increased human presence and use throughout the region. This led to an increase of paved and unpaved roads which affects many resources both positively and negatively. Implementing the route designations in SDNM reduces the number and density of unpaved roads. In the future, Arizona population is likely to continue rising and surrounding towns will increase in population, making SDNM their new backyard. Increased eco-tourism will also increase visitation to the SDNM. In the future (20+ years), more visitors will come to SDNM and will likely travel by motor vehicle. Increases in technology appear to reduce the carbon footprint of vehicle driving. BLM's capability to monitor lands using remote sensing technologies is likely to be increased to point where minor changes will be detectable leading to reduced response time to correct management issues.

The net effect of the negative past and present actions of population increase, road building and expected future population growth is that it is likely to be offset by the designation of the routes in SDNM, leading to better management of the SDNM and future increases in technology that allow for lower impact visitation. Air quality and green-house gas (GHG) emissions are likely to remain at current levels as fuel economy and alternative fuel vehicles increase. As visitors live closer to SDNM, trips will become shorter and emit fewer GHGs, thus offsetting increases in population.

# TRIBES, INDIVIDUALS, ORGANIZATIONS OR AGENCIES CONSULTED

Consultation regarding travel and vehicle management was conducted during the process of completing the SDNM RMP. A complete listing of organizations, individuals, agencies and tribes consulted during the RMP process is discussed in the Proposed RMP/Final EIS -Chapter 5. The RMP Scoping Report (2003) includes a detailed list of the interested parties and their issues. Below is a listing of parties consulted during the preparation of the RMP and the associated actions presented in this EA

Ak-Chin Indian Community
Arizona Game and Fish Department
Arizona Wilderness Coalition
Sierra Club
Tohono O'odham Nation
Town of Gila Bend
U.S. Air Force – Barry M. Goldwater Range
U.S. Border Patrol
U.S. Fish and Wildlife Service
The Wilderness Society

# LIST OF PREPARERS

**Table 13. List of Preparers**

| Contributing BLM Specialists | |
|---|---|
| **Name** | **Role / Expertise** |
| Tom Bickauskas | TMP Project Lead, Travel Management Coordinator, Vegetation and Soils Analyst |
| Steve Bird | Wildlife Biologist |
| Cheryl Blanchard | Archaeologist |
| Sharisse Fisher | GIS Specialist |
| Penny Foreman | SDNM RMP Planning Coordinator, Recreation Planner, Writer/Editor |
| Rich Hanson | Wilderness Specialist, SDNM Manager, Advisor |
| Dave Scarbrough | Recreation Planner, Sign Plan Author |

# REFERENCES

_____. 1990. Strategy for Desert Tortoise Habitat Management on Public Lands in Arizona. Bureau of Land Management, Arizona State Office, Phoenix. 19pp.

Blanchard, Cheryl L. and Tammi Sullivan, 2004, *A Cultural Resource Survey Along 14 Miles of Vekol Road, Maricopa County, Arizona*. Bureau of Land Management, Cultural Resource Project Record Form, BLM – 020 – 12 – 254.

Bureau of Land Management (BLM), U.S. Department of the Interior (USDI). 1988. Desert Tortoise Habitat Management on the Public Lands: A Range wide Plan. Bureau of Land Management, Washington, D.C. 23 pp.

Bungart, Peter W. and Anne E. Raney, 2007, *Cultural Resource Survey Along Selected Roads & Routes in the Sonoran Desert National Monument*. Circa Cultural Consulting, Cultural Report No. 06-30, Flagstaff, Arizona.

Homburg, Jeffrey A., Jeffrey H. Altschul, and Rein Vanderpot, *Intermontane Settlement Trends in the Eastern Papagueria: Cultural Resources Sample Survey in the Northeastern Barry M. Goldwater Range, Maricopa County, Arizona*. Statistical Research Technical Series No. 37,Tucson. 1994

Morrison, P.H., H.M. Smith IV and S.D. Snetsinger. 2003. The Natural Communities and Ecological Condition of the Sonoran Desert National Monument and Adjacent Areas. Winthrop, Washington: Pacific Biodiversity Institute.

Shirley, Shirley Lynn and Marcus P. Grant, *Revised Cultural Resource Survey Sonoran Desert National Monument, Former Area A, Barry M. Goldwater Range, Luke AFB, Arizona*. Geo-Marine, Inc., Las Vegas, Nevada, 2007

Stebbins, Robert C. 1985. Western Reptiles and Amphibians. Houghton Mifflin Company: Boston. pp. 153.

U.S. Fish and Wildlife Service (USFWS). 1988. Determination of Endangered status for two long-nosed bats, Final Rule. Federal Register 53(190): 38456-38460.